JUNE 1961

Volume 56 Number 6

FOUNDED 1905

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Veterinary Medicine • *Volume 56* • *Number 6* • *June, 1961*

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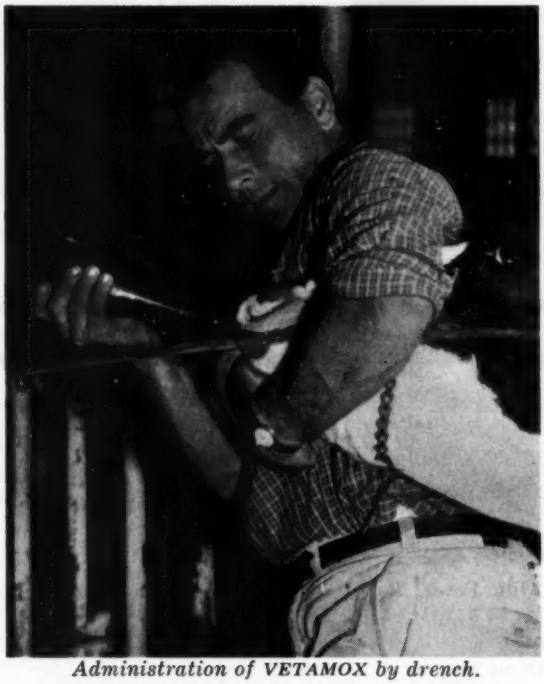

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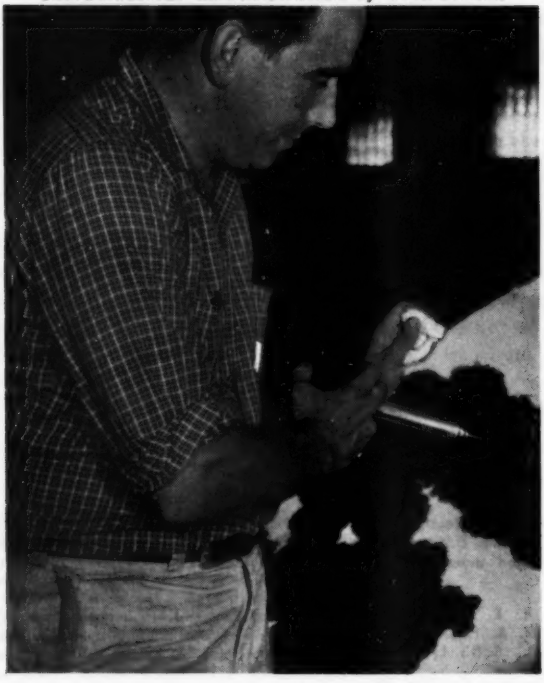

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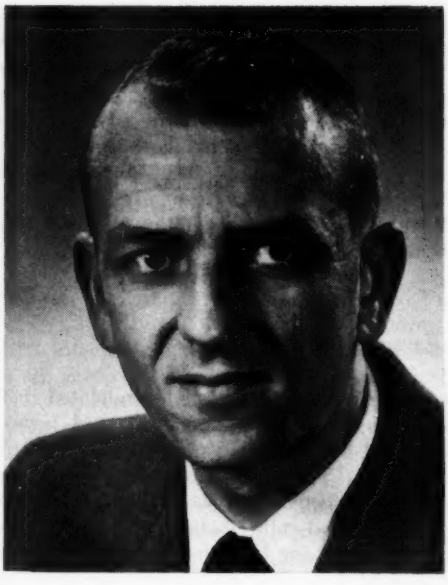
New Laboratory Tests For Hog Cholera Diagnosis



Robert L. Taylor, D.V.M.
Research Associate
Diamond Laboratories, Inc.

A simple laboratory test for the diagnosis of hog cholera is essential for eradication of this disease. Present methods utilizing swine inoculation tests are expensive and time consuming. Due to the severity of the disease all conditions, even faintly resembling hog cholera, must be treated as such. This results in added expense and confuses the diagnosis where hog cholera is not involved. Various laboratory testing procedures[1,2,3] which have been reported all have limitations and most have been discarded. The objective of this work was the development of a simple test that can be performed in the field by a practitioner without special equipment.

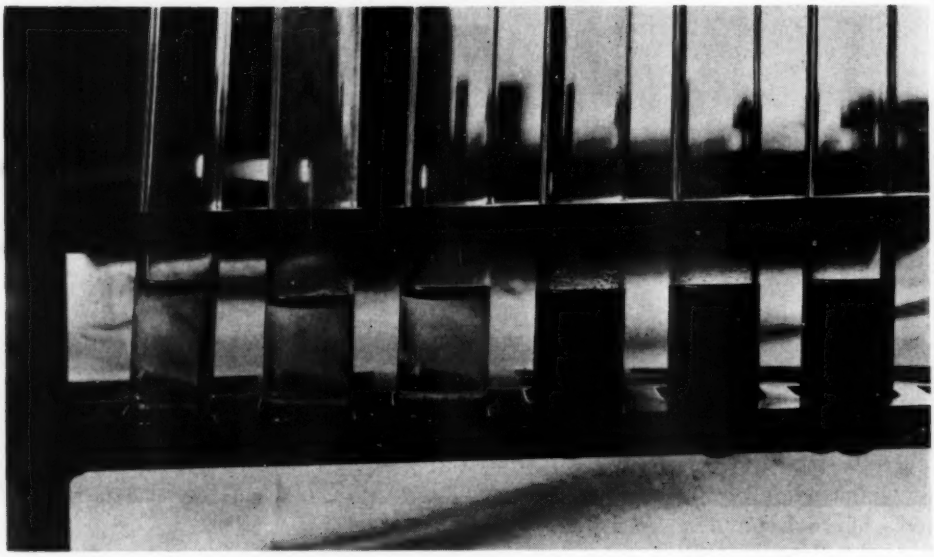


Fig. 1. Amylase test: Clear tubes contain pancreatic extracts from normal hogs, starch and iodine. Dark tubes contain pancreatic extracts from hog cholera infected hogs, starch and iodine.

Materials and Methods

Blood taken by cardiac puncture from a healthy mature rabbit was mixed at a 1:1 ratio with Alsevers solution. This mixture was diluted 1:10 in physiological saline as red blood cells were needed.

A 1% soluble starch solution was prepared and autoclaved before use. Five and one-half grams of iodine crystals and 11.0 gm. KI were dissolved in 250 ml. of water.

A portion of pancreas weighing approximately 5 gm. was removed from the anterior half of the gland and placed in a sterile petri dish. The tissue was minced with scissors and placed in a small bottle containing 10 ml. of saline. The minced tissue was shaken and clumps were allowed to settle. Only supernatant fluid was used in the tests. Extracts of normal pancreas were tested simultaneously as controls.

Three drops of the pancreatic extract, 3 drops of saline, and 3 drops of rabbit red blood cells were mixed in a Wasserman tube. The fluids were agitated, incubated in a water bath at 40 C. for 2 hours and observed for hemolysis.

Three drops of pancreatic extract were mixed with 3 ml. of starch solution in a test tube, incubated in a water bath at 40 C. for exactly 5 minutes and then 1 drop of iodine was added to the solution. The solutions were mixed thoroughly and the color observed. If a water bath is not available, another source of heat such as warm tap water or a hot air register may be used. Care should be taken to obtain the optimum temperature of 40 C. for best results.

Experiments

Preliminary experiments indicated that extracts of normal pancreas would hemolyze red blood cells, usually within 1 hour. However, pancreatic extracts from hog cholera infected pigs would not hemolyze the red blood cells. Instead a round button is formed at the bottom of the tube due to

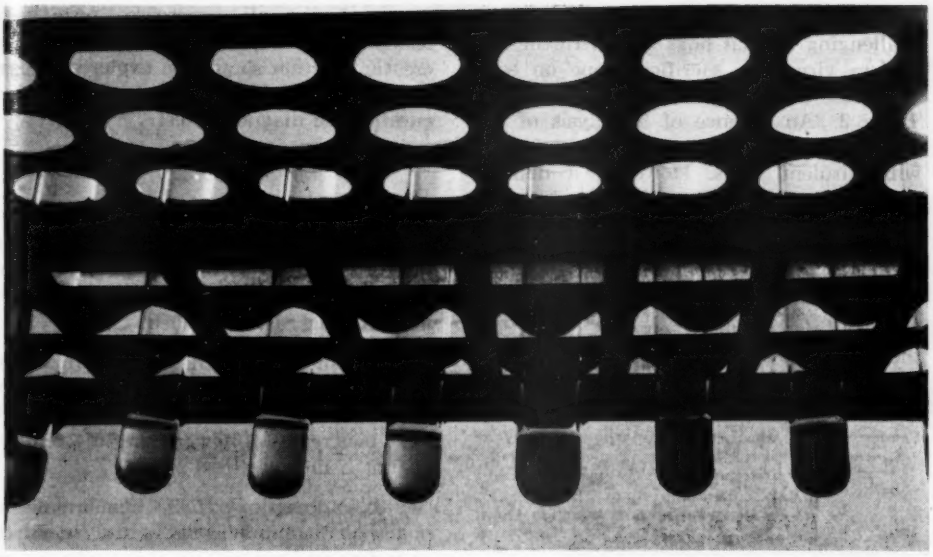


Fig. 2. Hemolysis test: Clear tubes with buttons contain pancreatic extracts from hog cholera infected hogs, rabbit red blood cells and saline. Tubes with diffuse color contain pancreatic extracts from normal hogs, rabbit red blood cells and saline.

the settling of the red blood cells (Figure 1). The hemolysis phenomenon was first observed while working on a hemagglutination test using pancreas as a source of virus. Identical results were obtained with rabbit and swine red blood cells, but bovine cells were not hemolyzed. Results using chicken red blood cells were erratic.

The specific cause for the results obtained with the hemolytic test is not known. It was assumed that the hemolysis might be caused by an enzyme, so tests were initiated to determine if there was a difference in amylase activity of infected and normal pancreases. A difference in the amylase activity of extracts from normal and infected pancreases was found. Extract from the pancreas of normal pigs produced a yellow color in the amylase test, indicating hydrolysis of starch by amylase present in the pancreatic extract. Pancreatic extracts obtained from pigs infected with hog cholera produced a dark blue or purple color due to the presence of starch and lack of hydrolysis (Figure 2). Results obtained with the hemolysis and amylase tests using pancreases from unvaccinated, vaccinated and hog cholera infected hogs are shown in Table 1.

TABLE 1

Hemolytic and Amylase Activity of Pancreas Extracts From Normal, Immune and Hog Cholera Infected Hogs

Pancreas Extracts of Hogs	No. Pancreases Over Total Showing Hemolytic Activity	No. Pancreases Over Total Showing Amylase Activity
Hyperimmune[1]	19/20	10/10
Normal Unvaccinated	5/5	5/5
Normal from Slaughterhouse	10/10	14/15
Infected with Virulent Virus[2]	0/30	0/20

[1]Immune hogs given large doses of virulent virus for the production of hyperimmune hog cholera antiserum.

[2]Hogs used for production of hog cholera virus and inoculated with virus six days before sacrificing.

At the present time these 2 methods are being compared for accuracy. Preliminary tests indicate that the hemolysis test

is more sensitive. This was determined by challenging normal hogs with virulent hog cholera virus and sacrificing one on each day after challenge. Results are shown in Table 2. An absence of hemolysis of red blood cells is noted 3 days after infection with virulent virus. However, a definite diminishing of amylase activity does not occur until 5 days after infection. Starting on the third day, progressively darker shades are produced until a deep blue color occurs at 5 days. It is possible that the amylase test can be made more sensitive by varying the concentration of the test ingredients.

TABLE 2

Comparsion of Hemolytic and Amylase Activity of Pancreatic Extracts from Hog Cholera Infected Hogs and Their Febrile Response

Tests	Reaction on Post Infection Days 0	1	2	3	4	5	6
Hemolysis	+	+	+	-	-	-	-
Amylase	+	+	+	+	±	-	-
Febrile Above 104 F	-	-	-	+	+	+	+

Discussion

It is assumed that hog cholera virus, on entering the acinar cells, alters or inhibits their normal enzyme functions. Because of the difficulty in obtaining samples from pigs with conditions similar to hog cholera, little information is available as to how the test will react in other infections. Major emphasis should be placed on determining the reaction of the tests in other swine diseases. Data is being accumulated on samples submitted from diagnostic laboratories. However, this process is extremely slow and it is hoped that this paper will stimulate work along these lines. Quantitative determinations of amylase content are made on all pancreases now being tested. Other methods of determining pancreatic function should be explored to find the one that is the simplest and most accurate for a diagnostic test.

Summary

1. Two simple laboratory tests showing differences between the activity of pancreatic extracts of normal and hog cholera infected pigs are described.

2. Pancreatic extracts of normal and hog cholera immune pigs hemolyze red blood cells of rabbits. However, extracts from pancreases of hog cholera infected pigs do not hemolyze these cells.

3. Pancreatic extracts of normal and hog cholera immune pigs hydrolyze starch, as indicated by a yellow color with iodine. This hydrolysis is assumed to be due to amylase activity. Pancreatic extracts obtained from hog cholera infected pigs do not hydrolyze starch as rapidly. This is indicated by the formation of a purple color with iodine as an indicator.

4. From data presented it appears that the pancreas deserves greater attention in hog cholera and possibly in other diseases than was formerly indicated.

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Evaluation of Swine Feed Additives

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The swine feed additives market is estimated to be about 40 million dollars per year or about 1/3 of the total feed additives market for all classes of livestock and poultry. There are 11 groups of swine feed additives, ranked according to frequency of use, in Figure 1. The most frequently used are at the top. Antibiotics make up the largest total dollar market volume. It is estimated that 80% of the total antibiotics used in feeds go into swine feeds.

All functions of the various additives used may not be completely known, but based on research to date, the listing of primary and secondary functions of the various additives appears justifiable. Figure 1 begins to show some of the "sense" in the swine feed additives presently in common use.

Different swine feed additives have different functions and dollar values depending upon (1) the level fed for (2) a given purpose during a specific stage of the life cycle. It is also recognized that the interrelationships of additives and nutrients must also be considered in their simultaneous use. Therefore, it is important that the "dollars and sense" of each additive be appraised in terms of its effective level for a specific function during a certain period or stage of the life cycle.

Feed additives commonly used during the life cycle of swine nutrition are shown in Figure 2. The use of each additive for various purposes during different stages of the life cycle is indicated by a bar following the name of each class of feed additive. The wider the bar, the greater the use quantitatively of the additive during that particular stage or period.

In the past most nutritionists have evaluated different nutrients and additives for swine primarily on the basis of rate of gain and feed efficiency in growing and finishing swine.

Figure 3 illustrates the degree of improvement in animal performance (as indicated by the overall length of the bar from top to bottom) as we proceed to build up a balanced ration (from left to right), starting with corn alone and ending up by adding unidentified nutrients.

The upper portion of Figure 3 shows the improvement in animal performance as

measured in growing-finishing swine in terms of rate of gain and feed efficiency as the balance of the ration is gradually improved by the addition of various classes of nutrients and/or additives (from left to right).

The lower portion of Figure 3 shows the gradual improvement in animal performance in terms of herd health, long-time productivity and resistance to stress factors as the balance of the ration is improved. Figure 3 also shows that the bars in the lower portion increase in length downward as the ration is more completely balanced (from left to right). This improvement is generally based on observations, inasmuch as nutritionists have not applied sufficient biochemical and bacteriological criteria to give a complete appraisal on the entire value of each class of nutrient and/or additive.

The combined length of both the upper and lower bars must be considered in appraising the "dollars and sense" of the swine feed additive. In the future we should apply new biochemical, bacteriological and physiological technics in order to more completely evaluate the nutrient and/or additive.

Trace Minerals. Figure 4 illustrates the value of trace minerals when fed during the different stages of the life cycle, presented in terms of measured performance values, dollar-cost and returns, and relative unmeasured values, which was referred to previously in the discussion on Figure 3. From Figure 4 it will be observed that the greatest return in both dollar-value and relative unmeasured values for trace minerals is during the baby pig period from 10 lb. to 50 lb. The second greatest return comes during the stages of pregestation, prebreeding, gestation, prefarrowing and lactation. The third most profitable stage to feed trace minerals is during the period from 100 lb. to market weight.

The dollar-costs and returns, along with the relative unmeasured values (shown by the arrow scale) have been calculated from reliable research data from agricultural experiment stations.

Figure 1.

GENERAL KNOWN FUNCTIONS OF COMMONLY-USED SWINE FEED ADDITIVES

FUNCTION / ADDITIVE	MAINTENANCE	REPRODUCTION	LACTATION	GROWTH	FEED EFFICIENCY	CARCASS QUALITY	PALATABILITY CONTROL	DIGESTION-ABSORPTION REGULATION	METABOLIC PRESERVATION	NUTRIENT FLORA CONTROL	INTESTINAL PARASITE CONTROL	DISEASE PREVENTION
TRACE MINERALS	1[a]	1	1	1	1			1	1		2[b]	2
VITAMINS	1	1	1	1	1	2	2	1	1		2	2
ANTIBIOTICS		2		2	2						1	1[b] 1
ARSENICALS				1	1	2			2		1	1
SWEETENING AGENTS FLAVORS				2	2	2	1					
ANTIOXIDANTS MOLD INHIBITORS	2	2	2	2	2		2	2	2	1		
ANTHELMINTICS				2	2			2			1	
NITROFURANS				2	2						1	1
IODINATED CASEIN			2	2	2			2	1			
ENZYMES				2	2			1				
AMINO ACIDS	1	1	1	1	1	1		1			2	2

[a] 1 = PRIMARY FUNCTION, 2 = SECONDARY FUNCTION

[b] HYGROMYCIN

W. O. R. F.

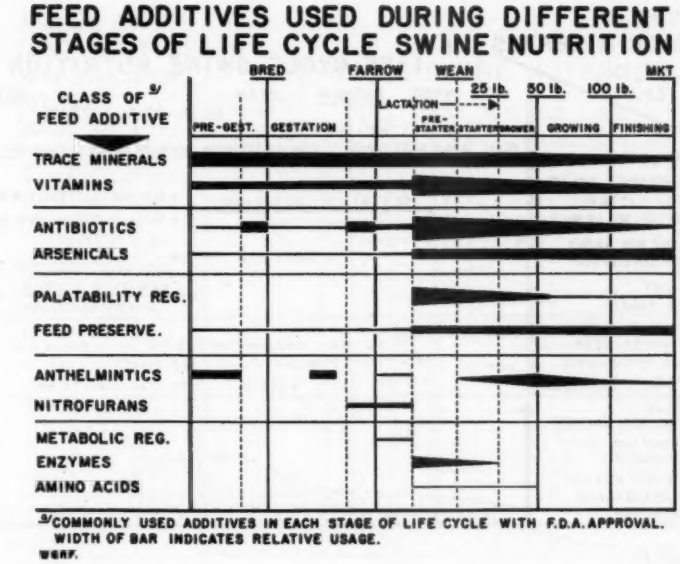
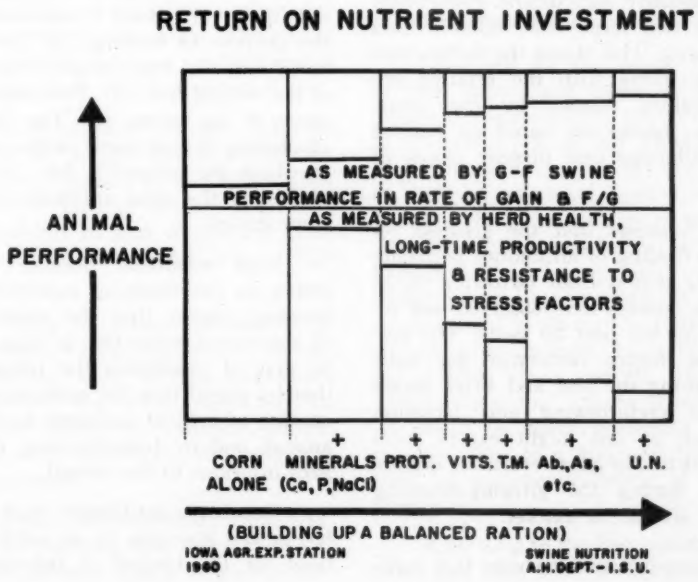


Figure 2.

Figure 3.


RETURN ON NUTRIENT INVESTMENT
ANIMAL PERFORMANCE
AS MEASURED BY G-F SWINE PERFORMANCE IN RATE OF GAIN & F/G
AS MEASURED BY HERD HEALTH, LONG-TIME PRODUCTIVITY & RESISTANCE TO STRESS FACTORS
+ + + + + +
CORN ALONE
MINERALS (Ca, P, NaCl)
PROT.
VITS.
T.M.
Ab., As, etc.
U.N.
(BUILDING UP A BALANCED RATION)
IOWA AGR. EXP. STATION 1960
SWINE NUTRITION A.H. DEPT. - I.S.U.

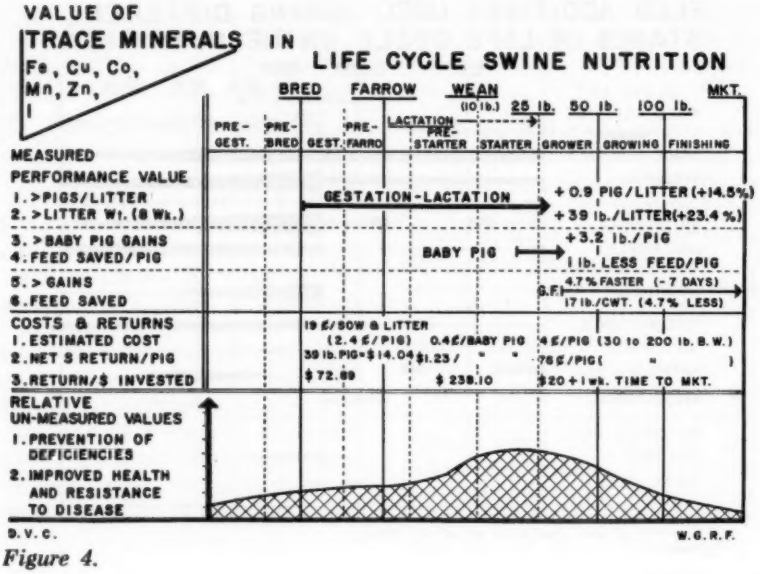


Figure 4.

Antibiotics. An appraisal of the value of antibiotics (chlortetracycline, oxytetracycline, penicillin, streptomycin and bacitracin) is shown on a life cycle basis in Figure 5. The measured performance values, based on extensive agricultural experiment station data and large-scale, reliable field tests, are shown. This shows the dollar-costs and returns, along with the relative unmeasured values (shown by the arrow scale). The figures are based on current costs of antibiotics and present prices of swine.

Figure 5 shows that the greatest return for the feeding of antibiotics is during the baby pig period from farrowing to 25 lb. Research workers have observed and reported this for the past 10 years. The second greatest return dollarwise for antibiotics is during the sow and litter stages (during the prefarrowing and lactation stages). And, as one might expect from research reports, the least return for dollars invested is during the growing-finishing period from 100 lb. to market.

This extensive survey shows that antibiotics have both "dollars and sense" values during prebreeding, prefarrowing and the baby pig period up to 25 lb. or 50 lb.

The following factors are known to influence the response to antibiotics in swine nutrition: (1) Kind of antibiotic fed and the purpose of feeding, (2) Level of antibiotic fed, (3) Age (stage of the life cycle) of the animal fed, (4) The nutritional adequacy of the ration, (5) The "stress level" (including disease level) of the environment in which the animal is fed, (6) Duration of feeding the same antibiotic in the same environment.

Most scientists, working closely together in the fields of nutrition and bacteriology, agree that the mode of action of antibiotics, when fed, is largely confined to that of modifying the intestinal flora, thereby permitting the synthesis of, and/or sparing of critical nutrients needed by the animal and/or toxin-forming microorganisms injurious to the animal.

Absorbable antibiotics, when fed at high levels, can give rise to an antibiotic blood level for the control of infections in the

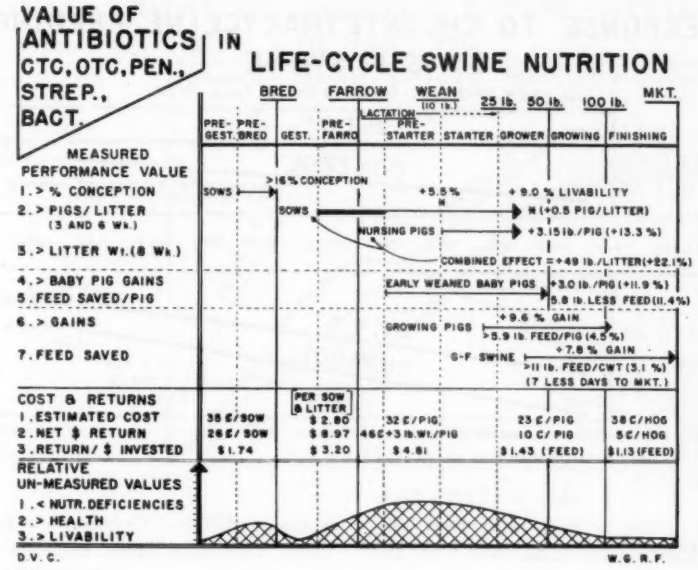


Figure 5.

animal not confined to the gastrointestinal tract.

Early research indicated that the feeding of antibiotics to swine reduced the variation between pigs within litters when fed from weaning to market weight. The variation of pigs within litters at market time is 4 times greater than litters on antibiotics.

Here is an often overlooked value in terms of "sense" in the use of antibiotics in growing and finishing swine rations. This means that the farmers market hogs will be more uniform in size at market time with closer marketings and fewer "tail enders."

The feeding of certain antibiotics is known to "spare" certain nutrients. It has been established that various antibiotics exhibit different degrees of specificity in their "sparing" effects on riboflavin, niacin, pantothenic acid, vitamin B_{12} and folic acid in swine nutrition.

Chlortetracycline can spare riboflavin, niacin and pantothenic acid in growing-finishing swine rations. There is also extensive experimental proof that different antibiotics can spare other classes of nutrients, such as protein in swine feeding. This phenomenon of "nutrient sparing" by antibiotics has been demonstrated extensively in other species such as rats and poultry.

Inasmuch as the exact requirements of both known and unknown nutrients required by swine during the different stages of the life cycle is not known, it is not always possible to provide the exact level of different nutrients needed in swine rations for the various stages of the life cycle. Therefore, there are logical advantages of having the "nutrient sparing" value of antibiotics functioning in rations to permit optimum animal performance. Certain nutrient requirements are many times increased during specific stress periods. Therefore, the "nutrient sparing" effects of antibiotics are no doubt of value preceding such stress periods, prior to a diagnosis indicating the need of therapeutic levels of certain nutrients.

According to the best summary to date, there has been little or no decrease in the

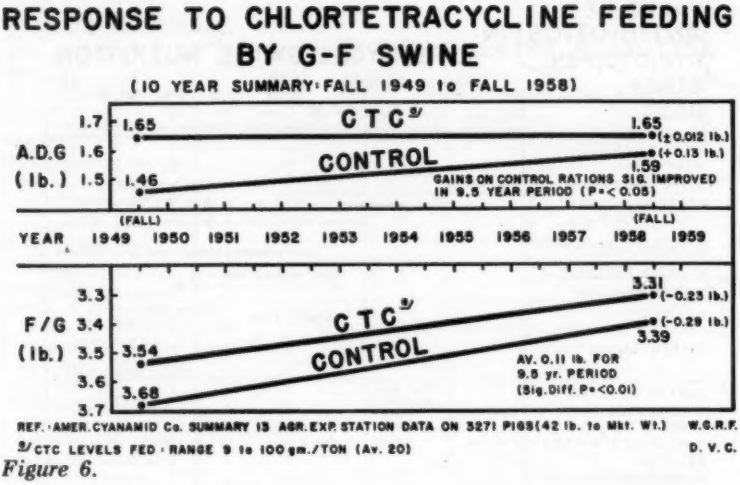


Figure 6.

performance (rate of gain and feed efficiency) of growing-finishing swine by the continuous feeding of antibiotics. Figure 6 shows a summary of the results of research from 13 agricultural experiment stations involving 3,271 pigs from 42 lb. to market weight. It shows that the average daily gain of the pigs fed chlortetracycline did not change over the 9½ year period from the fall of 1949 to the fall of 1958. However, the average daily gain of the pigs on the control rations improved significantly over this same period of time.

Feed efficiency improved for both the chlortetracycline and the control-fed pigs. Using the criteria of rate of gain and feed efficiency, the nutritionist would conclude from these data that antibiotics have not lost their desirable effects, which was observed earlier, and there has been a significant improvement in the nutritive balance of rations during the 10-year period. This is reflected in the improvement in feed efficiency of both chlortetracycline and control-fed pigs.

Thyroprotein for Sows. Carefully controlled research has shown that the feeding of thyroprotein (100 mg./lb. of total ration) will increase both the colostrum and mature milk flow of both gilts and sows. Extensive field tests support this research under most farm conditions. Thyroprotein-fed sows not only raise more pigs but heavier pigs in their litters.

Based on these findings the entire Swine Nutrition Research herd at the Iowa Station has been fed thyroprotein for 2 years. This would amount to about 550 litters per year. It has increased 3 and 5 week lactation pig weights 7.6% and 11.5%, respectively.

From the "sense" approach, both research and experience indicate that not only the level of thyroprotein is critical, but also it is known that a high energy ration must be full fed from farrowing until the pigs are at least 3 weeks of age, if maximum benefits are to be obtained from the use of this additive.

Digestive Enzyme in the Baby Pig. Research has proven that baby pigs do not have fully developed digestive enzyme systems up to 5 or 6 weeks of age. Figure 7 shows the development of different digestive enzyme systems in the baby pig from birth to 6 to 8 weeks of age.

It is now obvious if we are going to feed the baby pig anything, either on or off sows, we should feed him (1) something he can more adequately digest, like rations

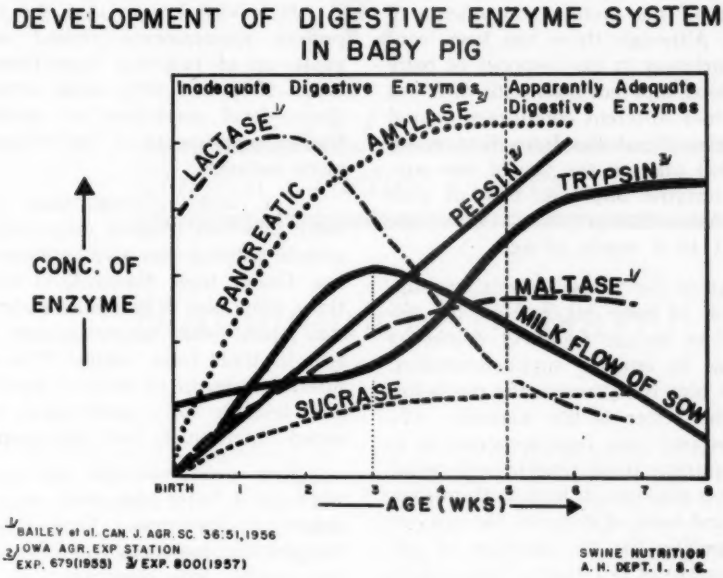


Figure 7 (above).

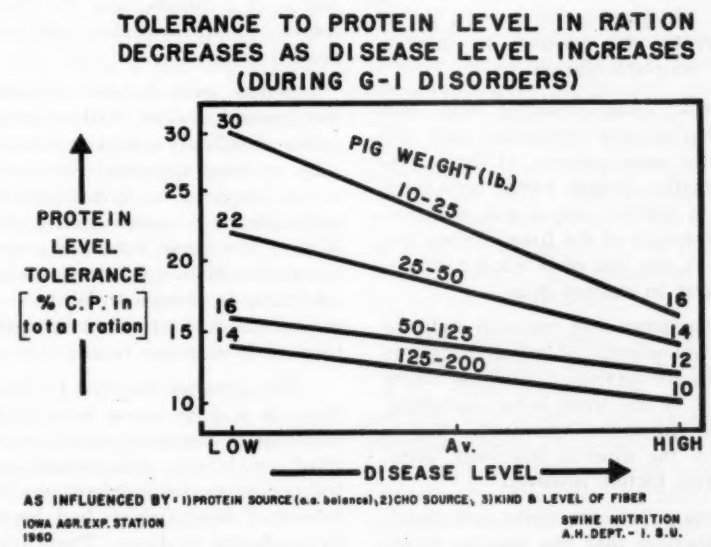


Figure 8 (below).

composed largely of dried skim milk or (2) rations supplemented with sources of enzymes "of choice."

During the past 5 years the Iowa Station has conducted over 50 experiments involving over 4,500 baby pigs in evaluating different sources and levels of enzymes for either ration supplementation or for the

predigestion of the protein components of the ration. Although there has been considerable variation in the response of baby pigs to rations supplemented with different enzymes under different conditions, a total of 20 experiments at the Iowa Station involving 1,349 pigs on the use of one supplemental enzyme improved rate of gain 4.9% and feed efficiency 3.8% during the period of 1 to 6 weeks of age.

Turning to the "sense" of enzyme supplementation in baby pig rations, the following factors appear to affect degree of pig response to enzyme supplementation: (1) Age of pig: the younger the pig below 6 weeks, the better is the response. (2) Type of ration: the best response is to rations containing plant protein and carbohydrates, less response in high milk rations. (3) Kind and level of enzyme: the enzyme must be specific for the function at pH and temperature of G-I tract of pig and be added at an optimum level. (4) Rate of food passage through G-I tract. (5) Level (amount) of feed intake: the greater the food intake, the greater the growth; therefore, the greater the response to enzyme "of choice" supplementation.

Arsenicals. Both arsanilic acid and 3-nitro-4-hydroxyphenylarsonic acid are widely used in swine rations. At their optimum and legally allowed levels, both have been shown to improve rate of gain and feed efficiency. Research at the Iowa Station has indicated that the use of 3-Nitro also decreases backfat in market hogs.

Both experience and research indicate that the requirements of some nutrients and additives are increased, whereas others are decreased, as the stress level (including disease level) increases. Obviously, this is influenced by the kind of nutrients, additives and stress factors involved.

For many years, practicing veterinarians have observed that the protein levels in swine rations must be lowered as the disease level increases. This interrelationship, shown in Figure 8, has been proven in swine nutrition experiments during the past 10 years.

It is well known that the baby pig's protein requirements (based on rations made up of practical ingredients) is between 25% and 30% under relatively low disease-level conditions of carefully controlled experiments at agricultural experiment stations.

Yet, under average farm conditions, baby pigs can tolerate only 18% to 20% protein without excessive looseness or scouring. Under high disease-level farm conditions, baby pigs of the same weight and age can tolerate only approximately 16% protein in their total ration. This important interrelationship of protein level and disease level is fully appreciated by experienced nutritionists and veterinarians.

Hog producers get quite concerned when their baby pigs show even a slight degree of looseness. They have always thought that looseness was a forewarning to real trouble with diarrhea.

There are definite interrelationships between stress level, the nutritional adequacy of a ration, and the degree of response to antibiotics and unidentified growth factors.

Stress level includes disease level in the present concept. With a low stress level and a completely adequate ration (theoretically an ideal situation), the result is little or no response to feed additives such as antibiotics and unidentified growth factors. With a low stress level and a nutritionally marginal ration, a greater response to these additives is obtained. With a very high stress level and an adequate ration, an intermediate response results.

The greatest response is obtained when there is a high stress level and a ration deficient in nutrients which would be supplied by either unidentified growth factor *per se* or by nutrients synthesized by intestinal flora (which had been modified by antibiotic feeding). These interrelationships of stress level, nutritional adequacy and degree of response to certain feed additives are becoming more and more appreciated as an important concept by both nutritionists and veterinarians.

General Practice Topics

Management of Navel Ill

On farms where year around farrowing is practiced pigs are farrowed in a central maternity unit. At 3 weeks they are moved to a separate nursery and at 8 weeks to the feeding floors where they remain until they are marketed.

Even though sanitation is good, the continued ingress and egress of sows at the farrowing house over a period of time seems to result in a build-up of viral and bacterial pathogens. Sows brought into the farrowing house only 24 hours before farrowing have insufficient time to build up immunity against the environmental bacteria and viruses of their new maternity quarters. As a result, their colostrum contains no antibodies specific against bacteria and viruses of the farrowing house. Their baby pigs are susceptible to many types of environmental micro-organisms which precipitate the occurrence of infectious scours and respiratory diseases.

Under multiple farrowing practices, navel ill can become a serious and costly problem. The customary farm practice of painting the severed navel cords with tincture of iodine does a poor job of prophylaxis in the multiple farrowing house.

Dr. Harvey Helms, Trimble, Mo., reported observations on navel ill morbidity and mortality among 30,000 pigs farrowed at 3 large scale integrated hog farms. In his studies 30 sows farrowed 284 pigs. All pigs were observed carefully from 3 days old to weaning at 4 weeks of age. The navel stumps of all pigs were treated with iodine just after birth. A total of 37% or 105 out of the 284 pigs developed navel ill damage, ranging from swollen cords to deaths by pyemia. Surviving pigs weighed an average 3.1 lb. less than normal pigs at 4 weeks of age.

In these studies the preventive and curative values of antibiotics were studied. Oxytetracycline, bacitracin, chlortetracycline, and furacin, either injected into the sows and pigs and/or fed to the sows and pigs, according to manufacturers' directions were of no value. The incidence of navel ill was about the same in the treated pigs as in the controls. And, as stated previously, postnatal application of iodine did not reduce the incidence.

A point of interest is that a goodly percentage of the sows in a multiple farrowing house where there is a navel ill problem will show a post-partum vaginal discharge within 2 to 5 days after farrowing. It is significant that a streptococcus (characteristically *Streptococcus uberis*) can be isolated both from the vaginal discharge of affected sows and also from the infected navels in the pigs.

What are the practical control procedures against navel ill losses in a high incidence herd?

(1) The first step is, if possible, to bring sows into the farrowing house area for 2 weeks before their farrowing date so that they have time to develop colostral antibodies for their newborn pigs.

(2) As shown by Dr. Helms, a 10 cc. dose of standard Porcine Mixed Bacterin No. 2, 30 days before farrowing, and a subsequent 5 cc. dose to each sow 15 days before farrowing, lowered navel ill incidence about 50%.

(3) At 30 day intervals, steam cleaning the farrowing house, followed by saturation with cresylic acid dip, will further lower the incidence.

(4) The most efficient approach and one which lowered the navel ill incidence by 98% on controlled split litter tests is as follows:

Each pig is caught in a sterile plastic bag as it is removed from the sow at birth. The navel stump is then ligated flush with the belly skin using No. 2 silk suture and soaked by dipping in tincture of iodine. In practicing it, according to Dr. Helms, one must figure labor cost per sow of 3½ man hours.

In the close economy of a large scale hog farm, any pigs from which pus can be squeezed from the navel stump or that have detectable arthritis (or both) should be destroyed at once, as they will never make profitable gains. Those that have a palpatable enlargement of the cord can be segregated and some salvage gained by antibiotic injections and a sulfonamide in the creep feed.

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Swine Enteroviruses

Enteroviruses were isolated from rectal swabs of approximately 30% of 52 groups of 40 lb. to 60 lb. Iowa pigs. These viruses produced 2 different types of cell destruction in primary swine kidney cell cultures. When these same groups of pigs were sampled approximately 45 days later, all but one of the infected groups were negative. However, 6 additional groups were infected.

The presence of enteric viruses had no significant effect on the feed efficiency of the infected groups of pigs. No detectable clinical disease was associated with these enteric viruses.

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Proc. 64th Ann. U. S. Lvstk. Sanit. Assn.

Differential Diagnosis Of Swine Abortions

The 2 most common causes of abortion in swine are probably brucellosis and leptospirosis. In each of these infections, the routine and fastest method of demonstrating the presence or absence of the infectious agent is by means of a serological test with blood from the dam. The agglutination test for brucellosis is a dependable indicator; however, for conclusive proof efforts should be made in each case to cultivate the causative bacterium from the specimen fetus. If cultural methods prove successful, differential brucella typing methods may be used if desired.

In leptospirosis, positive agglutination test results are subject to questionable interpretation unless they are supported by good clinical evidence or a very high titer. Bacteriological methods for cultivation and identificaion of the causative organism may be used; however, this procedure is time consuming and the percentage of successful isolations is rather low.

Histopathological examination of silver stained kidney sections from the fetus are much more useful in swine than in cattle. Occasionally, dark-field examination of urine from the dam or of urine and kidney scrapings from the fetus may provide evidence for a tentative diagnosis.

Other bacterial organisms associated with swine abortions can be discussed as a group. It is composed of erysipelothrix, listeria, streptococcus and corynebacterium organisms. The usual diagnostic procedure for each of these agents consists of bacteriological methods to culture and identify any of these organisms which may be present in the aborted fetus. In addition to recovery of any of these bacteria, it is necessary to eliminate other causes by means of history, serological tests and any other applicable procedures. The occurrence of any of these bacteria associated with swine abortions is quite erratic and not common. In a very few cases observed in which erysipelothrix was recovered, the abortion occurred at very close to full term. Some of the litter were dead at birth, others survived for a few hours and edema was quite noticeable. The over-all picture in these cases was quite similar to that of leptospirosis. However, no evidence of leptospirosis could be developed either from the fetuses or the sows. Streptococcus and corynebacterium organisms are very common in swine, and abortions may occur in droves in which the level of infection with these bacteria becomes quite high. The droves are usually those in which management and sanitation is below average and consequently the general health level of the drove is below normal. Almost invariably other conditions, such as umbilical infection, enteric conditions, atrophic rhinitis and pneumonia, can be found in the adult animals of these droves.

Bacteriological examination of aborted swine fetuses occasionally results in the recovery of a practically pure culture of of mycotic agents. The encounters in the Iowa laboratory with this infectious agent involved either aspergillus or penicillin species. In these cases it is always necessary to eliminate, as far as possible, any other causes of abortion, either infectious or noninfectious. Histopathological examination, using a fungus stain such as Gridleys, sometimes gives valuable support to the findings by other methods.

Cholera outbreaks are sometimes accompanied by abortions. Mortality of the adult animals usually attracts the attention of the owner more than the abortions; therefore, the abortions are sometimes overlooked in the history which is related in efforts to learn the cause of trouble in the adult. Practical methods for the diagnosis of cholera will depend upon a history, clinical evidence and postmortem examination of the adults rather than upon evidence secured from a specimen fetus alone.

On rare occasions abortions due to stilbestrol may be encountered. In these instances, it is necessary that an accurate history of availability of stilbestrol for ingestion by the sows be secured. They also require the elimination of other causes associated with swine abortions. Very sensitive biological assay methods for stilbestrol are available if needed.

Nutritional causes of swine abortion are not rare but they are often quite complicated and difficult to establish. In any case, the infectious causes should always be eliminated before considering nutritional factors. Such consideration will be concerned primarily with adult animals and must take into account the environment, management practices, nutritional requirements and the ration available, and concurrent diseases and parasitism. In a few instances, specific deficiencies may produce recognizable lesions of the fetus. For example, iodine deficiency usually results in edema and hairlessness. Vitamin A deficiency may produce palagnathism, microphthalmia and anophthalmia. Most deficiencies, however, are usually multiple in character and gross lesions cannot be depended upon to complete a diagnosis.

From this comparatively large list of infectious agents and noninfectious factors associated with swine abortions, it is apparent that the diagnostician must be prepared to cover several wide fields of investigation on each case he may examine. He should have a very good history of any clinical symptoms which may accompany

the abortions. The history should also include as much as possible of the environment, feeding and management practices and association with other species of animals. A rather wide variety of bacteriological media, stained histopathological sections, animal inoculation tests and biological assays may be needed. Consideration of the adult animals should never be neglected since their serological status and clinical history are often vital elements in establishment of a diagnosis when abortion is involved.

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Proceedings 64th Annual Meeting of the U. S. Livestock Sanitary Assn.

Hog Cholera Vaccination Studies

Serial passages of 4 rabbit origin vaccines, one porcine origin vaccine and one field virus were made in hogs.

The rabbit origin type of vaccines had the same general pattern of response to serial passage in all 4 samples tested. None of these vaccines produced reactions in the pigs in the first passages. One vaccine required 5 passages, one required 17 passages, one required 9 passages and another required 18 passages before reactions were visible in the pigs. All of the rabbit origin vaccines regained virulence when they were passed a sufficient number of times. The first reactions in most cases were more mild, of shorter duration and the pigs recovered quicker. As the number of passages increased, the severity of the reactions increased and death occurred with 3 of the 4 samples tested. The other sample did not cause any pigs to die. Some vaccines became pathogenic somewhat gradually, while others increased in pathogenicity quickly. There seemed to be an alternate pathogenic and nonpathogenic phase in these vaccines. In 1, 2 or 3 serial passages the pigs had a reaction. In some cases the pigs died. Then in the next 2 to 4 passages the pigs had no reactions but were immune when challenged.

In all but 4 passages in which pigs were used for controls or contact pigs, they were either immune or died before being challenged. It is, therefore, evident that under these experimental conditions the viruses did pass from the injected pigs to the contact controls. Those 4 controls which were not immunized apparently did not receive any virus or not enough virus to produce immunity. If the injected pigs had no reactions, the control had no reactions.

The swine origin vaccine began to cause reactions in pigs quicker than the rabbit origin vaccines, and it regained virulence quicker. This might be expected, since anti-hog cholera serum is required with the use of this vaccine.

Field viruses have been obtained from more than 100 herds in which pigs were dying after vaccination with modified vaccine. Some of these viruses are quite virulent and will kill susceptible test pigs. Some produce immunity without any visible reaction in susceptible pigs, and some produce reactions in test pigs but do not kill the pigs. There is no known way to determine if the virulent virus is of vaccine origin, but the nonvirulent virus must be of vaccine origin.

The action of a field strain virus in this study is very similar to those viruses used from the vaccines. It is, therefore, very probable that this virus was from the modified vaccine injected into the pigs on the farm.

No evidence of variant characteristics was observed in 4 of the viruses. One virus, when used with a test serum, caused a reaction in the pigs. They recovered and were immune.

The results strongly point out the need for anti-hog cholera serum to be properly used with live virus vaccines of rabbit origin to prevent eventual reactions and even death.

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Proceedings of the 64th Annual U. S. Livestock Sanitary Assn.

Things Worth Knowing About Skunks

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The skunk is a small, fur-bearing, nocturnal animal that is a good pet after descenting. In 1957 there were approximately 10,000 pet skunks in the United States. Since they are kept as pets by some, the veterinarian is frequently asked for information as to their care and habits and to descent them.

There are 18 or more subspecies of skunks in the United States, but they all can be recognized by their black and white markings. The common large striped skunk (Mephites mephites) is found in all parts of this country. They are the least popular of all our wild animals because of the disagreeable scent which they discharge when provoked. Yet they are very beneficial, as over 1,600 stomach analyses indicate. Nearly half of their natural diet is insects, 1/5 fruit and 1/5 mice. They are particularly destructive of potato beetles, grasshoppers, white grubs and the eggs of of turtles which destroy ducks. They are active at night during the fall and spring. It is at this time that many are killed by automobiles.

They are known by other names, as wood pussy, stink or pole cat and one species, the spotted or small skunk, is known as the civet or phoby cat. It is a tree climber.

The skunk is active all year. It may sleep for several days during very cold

weather, but does not hibernate. It is seasonally polyestrual and may mate from January to May. The gestation period is 62 days. Skunks give birth to 4 to 10 naked, blind young, usually in May. The babies' eyes will open in about 3 weeks, and they will nurse for 6 to 7 weeks. Only 1 litter a year is raised. Adults weigh about 8 lb. to 10 lb.; females are usually somewhat smaller. They will mate the first spring.

Skunks do make good pets and can be housebroken. They must be worked with, and the younger they are obtained, the better pets they will be. If obtained before weaning age, they can be fed with a nipple.

Pet skunks must be kept away from other skunks. They are fed commercial dog food supplemented with horse meat and raw eggs. Their diet should be high in vitamins A and D, so cod-liver oil makes a good additive. A harness should be used instead of a collar to tie or walk them. They cannot be shipped express unless deodorized. Some states require a license from the game and wildlife commission if they are kept as pets.

On either side of the rectum, just inside the anal sphincter, there are located large scent glands with ducts that protrude when the tail is raised. These can spray a fine mist, which has an extremely powerful, disagreeable odor, 6 to 10 feet. This clear, yellow fluid is slightly phosphorescent, highly volatile, strongly acid and contains a sulfide known as mercaptan. It can cause temporary blindness if it gets into the eye and will burn on the skin. The odor can be detected for about ½ mile. An artificial skunk oil (butyl mercaptan) is used to carry fire warnings in large mines. A few drops in the air circulating system flashes a silent warning where audible sounds could not be heard.

When a skunk stamps the ground with its forefeet and raises its tail, this is a warning. Ordinarily, there is no discharge, but if it believes it is in danger, one discharge will not empty the reservoir. An effective method to neutralize the odor is to wash everything with ammonia water. Ammonia water can also be sprayed in the room and is effective in clearing the air.

Skunks kept in zoos or as pets must be disarmed. This can be done at any time after 3 or 4 weeks of age, but is best before 6 weeks. The muscles of the scent glands are well enough developed after this age to discharge the scent.

Disarming is a clever, easy operation. The animal is covered with a towel, and diluted pentobarbital sodium is injected through the towel into the skunk, either I.P. or I.M. Ether, which is safer, may be used. As a safety precaution, a pane of glass is placed over the anesthetized animal and the penis-like ducts are protruded by gentle pressure on the anus and by rolling back the anal sphincter. A small forceps is clamped on the nipple but not locked as the tissue tears very easily. The mucous membrane is incised and the gland scraped out. It is necessary to cut a bit of elastic tissue which attaches the base of the gland. Some apply an antibiotic ointment or powder to the incisions. This is the only aftercare that is necessary. Skunks should be fed sparingly for a few days to prevent rectal prolapse.

Skunks are very susceptible to canine distemper. They should be vaccinated with two 1 cc. injections of a killed distemper vaccine at 3 week intervals. Only a killed rabies vaccine should also be used. The animal should be examined for lice, as this may be a problem. Any preparation that is safe to use on cats can be used on skunks. A 2% pine oil dip will also control lice.

Skunk fur is durable. It has been sold under such names as Alaskan Sable and Black Marten. It is no longer of sufficient value to warrant trapping.

The number of rabid skunks in the United States has doubled in the last 10 years. About 20% of the positive rabies cases have been in the skunk and fox. Because of their slow-moving and somewhat fearless nature, they are easy prey of rabid animals.

Management of Tuberculosis in Monkeys

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The increasing emphasis on the use of monkeys for medical research has increased the number of experimental monkey colonies. This removes the monkey from his normal environment and greatly increases his contact with man. Therefore, he not only lives in captivity but is exposed to new diseases.

Although the monkey is probably one of the most susceptible of domesticated animals and pets to tuberculosis, this disease is rarely seen in the animal's natural habitat. This susceptibility represents a prime hazard to the investigator using monkeys for chronic long-term experimentation. Because of this hazard monkeys in captivity are carefully tuberculin tested, and those found to be tuberculin positive are isolated and destroyed. The latter can be a very costly item, for many such animals may be involved in long-term projects lasting several years. Their relative value represents the sum of the cost of room and board, experimental man hours and a percentage of the maintenance cost of the experimental facilities.

When faced with the problem of a tuberculosis outbreak in our monkey colony several years ago, it was decided to attempt to treat a group of infected animals in order to preserve experimental continuity and avoid the excess expense of replacing the animals because of disease.

The tuberculin positive monkeys and their cage mates were immediately isolated from the remainder of the colony. Following the recommendation of Dr. L. H. Schmidt[1] these animals were immediately placed on

isoniazid therapy consisting of a daily administration of 80 mg./kg. given in 2 divided doses. Their tuberculin reaction was tested every month and a careful follow-up of their clinical status instituted. Minimum treatment was considered to be 6 months. The animals were kept in isolation for at least 6 months after the last negative tuberculin test. If the above requirements were fulfilled, the animals were returned to the parent monkey colony.

The results of the therapy are summarized in Table 1. Clinically, monkey S-3 appeared to have acquired the initial infection. The animal was tuberculin negative 1 month before he showed symptoms of wheezing and general lassitude. A tuberculin test on 11-19-56 was positive. This animal was immediately isolated and on 11-19-56 the entire colony was tested. Five other members of the parent colony were also tuberculin positive. These animals were immediately isolated, including 1 tuberculin negative cage mate, X-518. They were placed on isoniazid therapy as described previously and kept in isolation. Following 1 month of therapy S-3 and his cage mate S-1 remained tuberculin positive, whereas the other isolated animals were tuberculin negative. Monkey S-3 was negative on 7-3-57, and the others remained negative. The latter group of negative reactors, having remained negative for 6 months, were then returned to the colony on 7-3-57. Animal S-1 remained negative for 6 months and was also returned to the colony on 12-17-57. However, S-3 again became positive on 12-17-57 and his disease continued to progress despite isoniazid therapy. On 3-10-58, 3 of the treated animals (71, 87 and S-1) again became tuberculin positive, were re-isolated and placed on therapy. Concomitantly, 2 other monkeys in the colony became positive (T-19 and 180). Monkey T-19 was isolated and treated. Monkey 180 was sacrificed and found to have active tuberculosis. The animals with recurrent infection all were negative following therapy, but 2 again relapsed. However, in the latter animals, subsequent treatment resulted in the reversal of the tuberculin reaction. At the time of sacrifice only one of the treated animals, the initial reactor S-3, had evidence of active tuberculosis, which was generalized. However, with therapy he was able to be maintained for 2 years before his death.

TABLE 1

Results of Isoniazid Therapy on Tuberculosis Monkeys

Monkey	Type	Arrival in Colony	Sacrificed	Tuberculin Positive	Tuberculin Negative	Returned to Colony
			5-13-60			
71	(M.R.)	8-31-55	healthy	11-19-56	12-11-56	7- 3-57
180	(M.R.)	5-15-57	3-25-58	3-10-58		
			active tbc			
T-19	(M.R.)	9-22-54	8-29-59	3-10-58	6-30-58	
			healthy	7- 1-58	7-10-59	
88	(S.T.)	9- 3-59	11-19-56	11-19-56	12-11-56	7- 3-57
			healthy			
87	(S.T.)	8- 8-55	9- 1-59	11-19-56	12-11-56	7- 3-57
			healthy	3-10-58	6-30-58	10-20-58
PC-6	(M.R.)	4-25-54	9-13-59	11-19-56	12-11-56	7- 3-57
			healthy			
S-1	(S.M.)	1-13-59	11-11-59	11-19-59		
			healthy	4-17-57	7- 3-57	12-17-57
				3-10-58	6-30-58	
S-3	(S.M.)	12- 1-54	6- 9-58	11-14-56		
			generalized	4-17-57	7- 3-57	
			tbc			
				12-17-57		
				2-18-58		

X518 Cage mate of tuberculin positive animal 11-19-56, never developed a positive tuberculin reaction, was treated and sacrificed 5/6/57, a healthy monkey.

Associated with the one recorded relapse in the parent colony (note Table 1), only 2 animals developed a primary infection. Throughout this treatment period the animals in the colony were repeatedly tested and at no time did a generalized outbreak of tuberculosis occur. However, this required careful testing and isolation of animals at the least suggestion of a questionable tuberculin response. There has not been a tuberculin positive monkey found in the parent colony since 3-10-58.

While tuberculin testing helped to control the epizootic menace of tuberculosis, still those animals that became infected were customarily sacrificed in order to deter the spread of the disease to the remainder of the colony. On many occasions this has necessitated the complete extinction of a colony.[2,3]

While studying the effects of antituberculosis medications in monkeys, Schmidt noted that contrary to the usual experimental animal, the dog, monkeys could tolerate considerably more isoniazid in relation to their body weight because of a difference in the metabolic breakdown of the drug in these species.[4,5] By increasing the dosage of isoniazid he was able to eradicate the disease in the infected animals as well as prophylactically prevent the disease from occurring in exposed animals.[6] He further observed that adequate treatment led to a reversal of positive tuberculin reactions. The efficiency of larger doses of the antituberculosis drugs has been noted by others and used to treat active infections in primates and other animals.[7,8,9] These observations prompted Ruch in his recent book on the care of laboratory primates to suggest isoniazid as an inexpensive, easily administered, double-edged agent for controlling tuberculosis in a colony, rendering the diseased animal noninfective and the well animals resistant to the disease.[10]

The present observations certainly support this suggestion and serve to indicate that an outbreak of tuberculosis in a valuable experimental monkey colony need not mean that all of the animals need to be sacrificed, but rather they can be adequately treated and maintained until the completion of the project. Furthermore, the judicious use of antituberculosis therapy can prevent the rampant spread of tuberculosis to epizootic proportions following mild outbreaks of the disease within a colony.

Summary

An outbreak of tuberculosis in a colony of experimental monkeys was treated to save rather than destroy the infected animals. Tuberculin positive monkeys were isolated and placed on 80 mg. of isoniazid per kg. given in 2 divided daily doses. Six months is considered to be the minimum treatment period, but some were tuberculin negative within 3 months. All infected monkeys were tuberculin tested every month and kept in isolation for 6 months following the last negative test. Though there were some relapses, this colony was cleared of tuberculosis and only 1 of the originally infected monkeys had active tuberculosis when necropsied, nearly 2 years following the outbreak.

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Small Animal Practice Topics

Vacation Travel Tips For Dog Owners

Vacationing families will soon face the question of whether to take their dog with them. If they decide to take the dog, Purina Dog Care Center, St. Louis, Mo., offers some tips which will help to make the trip more enjoyable for all.

The first step should be to place a $10 bill in an envelope and put it in a safe place. This is to serve as a deposit to leave with hotel and motel owners to guarantee their faith in the good manners of the dog. They should ask the motel or hotel keeper to hold the deposit until they leave, at which time he may make an inspection of the quarters they have occupied. If the dog has been through an obedience training class, the certificate of graduation can be taken along. The manager is assured that the dog is obedience-trained and reliable.

It is usually much handier to stay at a motel. However, more hotels than motels will permit dogs in the rooms. While some hotels won't always permit dogs in the rooms, their garages will usually accept them. The dog will be in a warm, dry place with an attendant to watch out for him. In this case the car should be parked against a wall so that it won't have to be moved. It can be locked, with the windows left partly down for ventilation but not enough for the dog to climb out. If the motel does not permit dogs in the rooms, it is possible that he can sleep in the car parked nearby, provided he is the sort that won't bark all night.

The dog should wear 2 collars while traveling, one light chain-choke collar and one leather collar. The reason for this is to put an identification tag on one collar and the local dog license on the other. Even if the dog should lose one collar, he could be identified. If the dog is lost at one of the stops, definite arrangements should be made for his return. A description of the dog, together with forwarding instructions, should be left with the hotel or motel manager. The local authorities should be contacted and asked for their help. It's a good idea to leave a clear snapshot of the pet with them as an aid to positive identification.

A square of old blanket or the dog's sleeping pad should be taken on the trip. This is to be the dog's bed in the car. This blanket also serves another purpose. Neither the hotel nor motel people want the dog sleeping on the beds. The dog will feel more at home on his familiar bedding, too.

The dog's bowl, which can be used as his water dish first, then for mixing his

feed, should be taken along. He will have an added feeling of security from using his regular bowl. He should be fed dry food. Canned food can be taken, but unless the dog eats exactly a can a day, some is wasted.

The last really necessary item is a can of flea powder. The dog may start from home without a single flea, but he could pick some up along the way.

Some dogs don't like to ride in cars, and others get car sick. Both conditions may be caused by static electricity. A static belt hung from the car's axle and touching the pavement has cured some dogs. If the dog still suffers from motion sickness, tranquilizers or anti-motion sickness drugs may help. Some dogs will often overcome a tendency to car sickness after a few days of riding.

The dog's head should not be permitted to hang out the windows. Bits of grit may be driven into the eyes and the wind may cause a nasal and eye passage inflammation.

Bowed Tendons In the Horse

Bowed tendons can be classified as being either high or low. A tendon that is bowed from the interior check ligament to the top of the upper end of the synovial structure is a high bow. The average low bow involves the area from the middle of the cannon bone down to and including the structure of the fetlock itself. The condition has also been recognized in acute and chronic forms.

Probably more horses are retired from racing due to bowed tendons than from any other pathological condition. The etiological factors are: (1) The extreme speed and exertion thrown on the flexor tendons at the start of a race. (2) Forced training or pushing the preparation of animals before they are physically able. (3) Faulty tendons or tendons of poor quality. (4) Muscular fatigue toward the finish of a race or in galloping long distances, which causes extreme descent of the fetlock and, therefore, causes the tendons to support all the weight. (5) Improper shoeing or trimming of the feet, allowing the toes to become too long and the heels too low. (6) A heavy horse is more apt to bow than a light one because of the additional weight. This is especially true in a horse that has previously suffered a bowed tendon.

The name bowed tendon is misleading. It leaves a general misconception as to the actual pathology. In most instances the damage is done not to the tendon but to the tendon sheath. Tendinitis originating in the upper third of the metacarpal region usually involves the deep flexor tendon and its check ligament. Tendinitis that appears somewhat nearer the center of the cannon offers a somewhat better prognosis than does that which involves a joint. Either the deep or superficial tendons or both can be involved.

A good many slight bows consist of stretching of the superficial tendon, usually about its middle. The external bowed appearance is due to a thickening of the tendon sheath. There is excess synovial fluid present and varying amounts of adhesions and fibrosis surrounding the superficial and deep tendons. It is characterized by paratendinous fibrosis.

Tissues involved show signs of inflammation, heat, pain and swelling. The area may be very sensitive and extend from the carpus to the fetlock. Lameness is more marked in subcarpal or deep digital flexor involvement than in involvement of the perforatus or suspensory.

The first 48 hours of treatment should be the use of an antiphlogistic agent to reduce the inflammation. After the inflammation has been removed, the tendon can be subjected to therapeutic cautery, blistering and rest. The object of this treatment is to set up an acute inflammation in order to eliminate undesirable cicatricial tissue and to encourage the conversion of the

newly formed connective tissue into comparable tendinous tissue. A tendon will be completely healed in 13 months. Complete rest is the most essential part of the treatment. Six months is the minimum time required in mild cases and as long as 1½ years may be needed.

An operation for treatment of bowed tendons developed by Dr. D. L. Proctor has received wide attention. The operation consists of opening the sheath, swabbing out the excess synovia, breaking down adhesions and cutting the annular ligaments, plus opening of the superficial didital ring. Adhesions which follow the operation constitute the main threat to the success of this surgical treatment. The prognosis depends on the amount of pathological changes present. As a general rule it should be guarded.

Summary

One of the most serious injuries of a competitive horse is a bowed tendon. Only about 10% to 15% of the thoroughbreds with this condition return to racing at approximately their former value. Horses with very serious bows may return to racing, but it is very difficult to keep them sound. Rest is probably the best single treatment for bowed tendons and the time may vary up to 1½ years before training should be resumed.

Erysipelothrix Isolation From Mink

During January 1961, 3 live, approximately 8-month-old male minks were received from a Wisconsin ranch for routine diagnosis. Other than a general emaciation, no other external symptoms were noted. The rancher was concerned with the generally poor physical condition of the herd and wanted to determine the cause of this unthriftiness. The 3 animals showed a general progression of listlessness, anorexia, posterior weakness, followed by coma and death over a 3-week period of observation.

At necropsy, mink No. 1 was very emaciated, and the only apparent gross tissue changes were observed in the kidneys, which were soft and pale yellow in color. Mink No. 2 showed the same physical conditions and degenerative kidney changes, besides having a greatly enlarged spleen showing caseous whitish nodules over the surface. Mink No. 3 also was emaciated and had the same type of kidney degeneration.

Splenic cultures from mink No. 1 and No. 2 produced a filamentous Gram-positive organism which tentatively was diagnosed by biochemical methods as *E. rhusiopathiae*. In mink No. 2, *E. coli* also was isolated from the spleen and kidneys. An *Alcaligines sp.* was isolated from the spleen of mink No. 3.

The Gram-positive organism was pathogenic to mice and to pigeons. Mice previously inoculated with anti-swine erysipelas serum (horse origin) were unaffected following subsequent injection with the isolated culture, thus confirming it as *E. rhusiopathiae*.

Observations of *E. rhusiopathiae* infection have not been made frequently. A somewhat similar Erysipelothrix outbreak in mink kits was reported by Hartsough (*Jour. Am. Vet. Med. Assn.*, 107:242, 1945) on 2 ranches. Because of the use of packing-house by-products in the ranch mink diet, such infections undoubtedly do occur continuously. Although the total mortality need not be great, any infection, particularly of enteric origin, in fur-bearing animals can have a detrimental economic effect. Whenever generalized unthriftiness with eventual inappetence occurs over a prolonged period, food-borne bacterial infections should be suspected. Use of antibiotic sensitivity discs can aid in establishing an effective control measure in such instances.

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Clinical Observations: Pre-Surgical Sedation and Relaxation

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The encouraging results already reported on the use of tranquilizing agents with large animals[1,2] have suggested their trial in smaller animals, such as dogs, especially in animals about to undergo surgery. It was reasoned that the quieting effect of the tranquilizer would facilitate the administration of the anesthesia, perhaps permitting the use of a lighter plane of anesthesia than would be required, and would reduce or eliminate the need for further anesthesia during surgery. This lower dosage of anesthetics would markedly reduce surgical shock, especially in old or debilitated dogs.

Vetame (Trifluprom azine Hydrochloride, Squibb) was used in a series of dogs about to be operated on for a variety of conditions to test its efficacy in inducing sedation and as an adjunct for anesthesia. Vetame is a phenothiazine derivative identical with Vesprin (Squibb) which Stone has reported to be a superior agent in the sedation of human patients under local anesthesia.[3]

During the same period in our hospital Vetame was also given as an antiemetic to 2 dogs and as a tranquilizer to high-strung dogs that barked excessively.

Clinical Evaluation

Sixteen dogs were used in the evaluation of triflupromazine as a sedative and an adjunct to anesthesia. The animals ranged in age from 8 months to 15 years. Two-thirds of the dogs were males. When brought to the hospital, the majority of the animals were in good condition. Although a few were only fair, the condition of 2 was poor.

Combuthal (Abbott Laboratories) was administered intravenously according to body weight and to effect. This was followed by Vetame given intravenously except in 2 dogs. In most animals, the dose of Vetame (20 mg. per cc.) was 10 mg. Ether was used when needed for good relaxation.

Results

The animals remained anesthetized for the duration of the operation in most cases, even for surgery of more than an hour's duration. Ether, when administered, was generally required only in small amounts.

No evidence of toxicity was observed. The only complication that occurred in the

series was in the animal undergoing experimental aortic transplant. In this dog temporary respiratory failure followed the anesthesia but the condition was quickly corrected. Whether this complication was due to the anesthesia or other factors was not determined. A mild idiosyncrasy to the drug was observed in 1 dog (animal with breast tumor). In another case with urethral calculi poor relaxation was obtained with Vetame and Combuthal, and ether anesthesia was needed. Relaxation was good in the other cases, however, and no complications occurred in the post-operative period.

Among the non-surgical cases, Vetame also proved useful. In a dog with acute gastritis the response to Vetame was good, and vomiting was promptly brought under control. Food given during the evening of the day when vomiting ceased was retained. In 1 uremic dog the vomiting continued after Vetame was administered, but occurred less frequently.

Vetame proved to be an excellent tranquilizer in 2 dogs that barked excessively. One animal remained quiet following administration of Vetame, but the other continued to bark to some extent, but not as frequently as before treatment. The dogs

TABLE 1

Triflupromazine as a Sedative and as an Adjunct for Anesthesia in Canine Surgery

Condition of Dog	Type of Surgery	Route of Administration and Dose of Triflupromazine	Anesthetics used	Relaxation
6-yr. old poor	Exploratory Laporotomy	10 mg. I.V.	Combuthal	Excellent
16 lb. fair	Ventral Hernia	8 mg. I.V.	Combuthal and ether	Good
*	Fracture of Ramus Mandible	20 mg. I.V.	Combuthal 1 cc./5 lb.	Excellent
15-yr. old fair	Neck Tumor	5 mg. I.V.	½ cc./5 lb. Combuthal ¼ gr. morphine	Good (light)
*	Dislocated Coxo-femoral Joint	10 mg. I.M.	Combuthal, I.P. ether	Good
6-yr. old good	Aortic Transplant	10 mg. I.V.	1 cc./5 lb. Combuthal	Excellent
*	Removal of Pellets from Carpal Joint	10 mg. I.V.	1 cc./5 lb. Combuthal	Excellent
5½ month	Hysterectomy	½ mg./1 lb. I.V.	1 cc./5 lb. Combuthal	Excellent
*	Experimental Aortic Transplant	½ mg./1 lb. I.V.	1 cc./5 lb. Combuthal	Excellent
8-yr. old good	Repair, Perineal Hernia	½ mg./1 lb. I.V.	⅝ cc./5 lb. Combuthal	Good
*	Removal Breast Tumors	½ mg./1 lb. I.V.	⅝ cc./5 lb. Combuthal ether	Good
*	Neck Abscess	6 mg. I.V.	1 cc./5 lb. Combuthal	Good
*	Urethral Calculi	½ mg./1 lb. I.V.	¾ cc./5 lb. Combuthal ether	Poor
*	Cystic Calculi	½ mg./1 lb. I.V.	¾ cc./5 lb. Combuthal	Good
*	Pyometra	½ mg./1 lb. I.V.	½ cc./5 lb. Combuthal	Excellent
*	Ear cropping, Tail docking	½ mg./1 lb. I.V.	1 cc./5 lb. Combuthal	Good

*—Description of patient not furnished.

did not become stuporous, but responded when spoken to.

Discussion

Normally, the dose of Combuthal used for anesthesia is ¾ cc. per lb. of body wt. in healthy animals and 2/3 cc. per lb. of body wt. in old or toxic animals. The combination of this anesthetic agent with Vetame permitted the level of anesthetic to be markedly reduced. The barbiturate was administered slowly followed by the tranquilizer so that the full dose was administered in 60 seconds. The combination greatly reduced the surgical shock and permitted a smooth and rapid recovery.

The ease with which Vetame can be administered, the few complications occurring when it is used as an adjunct to other agents in both major and minor surgery, and its calming effect on unruly animals or animals in pain suggest that this drug will be of value in veterinary medicine.

Enge[4] has described the remarkable quieting effect of tranquilizers on cattle being prepared for shipping. He found the tranquilizing effect to be of long duration, the agent appearing to answer a definite need in the handling of stress in large animals. Similarly, Gorman[1] has employed tranquilizers in quieting undisciplined, frightened, and belligerent horses.

In humans, Stone has reported that trifluprom azine, injected either intramuscularly or intravenously, produces sedation comparable to that with other premedicating drugs, such as the barbiturates and other phenothiazine derivatives. Sleep is produced from which the patient can be aroused easily.

This tranquilizer aids by inducing relaxation in the dog about to undergo surgery and in reducing the amount of barbiturate needed. The ease with which anesthesia is maintained, the recovery without thrashing, together with almost complete lack of toxic reactions and post-operative complications, indicate that Vetame will prove to be useful to the veterinary surgeon.

TABLE 2

Trifluprom azine as Antiemetic and Tranquilizer in Dogs

Condition	Route of Administration and Dose of Trifluprom azine	Other Agents Used	Results
Acute gastritis	10 mg. I.M.	Sodium pentobarbital and belladonna	Good
Vomiting due to Uremia	10 mg. I.M.	None	Fair
To control barking	15 mg. I.M.	None	Fair
To control barking	20 mg. I.M.	None	Good

Summary

A series of 16 surgical procedures on dogs are described in which Vetame was used, in combination with 1 or more other anesthetics. Good to excellent sedation and relaxation was obtained in 15 of the animals. No evidence of toxicity was seen, except in 1 instance. The tranquilizer was also used to control vomiting in 2 dogs and excessive barking in 2 other dogs.

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Hemal Lymph Nodes in a Dog

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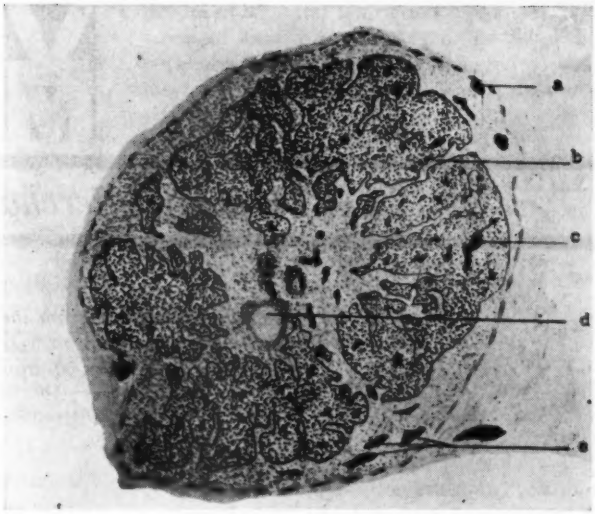
The occurrence of true hemal nodes in the dog is quite rare. Sisson and Grossman[1] state that they are numerous in the ox and sheep, much fewer in the dog and apparently absent in the horse and pig. Trautmann and Fiebiger[2] state that they are only found in ruminants.

During the routine dissection of a mature female Greyhound in the gross anatomy class at the School of Veterinary Medicine, Auburn University, 3 dark red nodes were observed in the root of the mesentery. Because of the extremely rare incidence of true hemal nodes in the dog, these masses were removed for cytological examination.

The microscopical findings were as follows: the capsule was quite thick and compact, and composed of parallel layers of collagenous fibers between which numerous fibroblasts, a few histiocytes and lymphocytes appeared. A few smooth muscle fibers and numerous blood vessels were found in the capsule. The trabeculae were fairly well developed and were composed of fibrous connective tissue richly supplied with smooth muscle. Numerous arteries radiated to the cortex and penetrated the cortical sinuses. The veins were not found to accompany the arteries in the trabecule but seemed to follow a winding course to the hilus in the engorged sinus region.

The parenchyma compared very favorably with that of the canine spleen. There were a few lymphatic nodules within the mesh of reticular stroma. These were not restricted to the cortical areas and did not display hemopoietic characteristics. The sinus areas greatly exceeded the extent of the lymphatic tissues, as is the case in the red pulp of the dog spleen. They were composed primarily of greatly engorged sinuses filled with those elements normally found in the circulating blood. In addition, macrophages with phagocytosed erythrocytes



A drawing of a photomicrograph of the sectioned hemal lymph node.

A. Blood vessel and capsule
B. Trabeculus
C. Venous Sinus
D. Lymphatic nodule
E. Blood vessels of the hilus area

and pigment were found. Close observation revealed the presence of arteries in the lymphatic nodules; these appeared emerging from the nodules and continuing into the sinus spaces as rather thick-walled arteries. Numerous large thin-walled venous sinuses occupied the sinus areas. They contained only the elements of the normal circulating blood.

From the study of these specimens it would seem logical to classify these structures as true hemal nodes, in that they meet the classifying requirements of such nodes as found in ruminants. Such characteristics are as follows: They are independent of the lymphatic system but occur in regions where lymph nodes are normally present. Their parenchyma resembles that of the spleen, particulaarly the red pulp. The vascular pattern resembles that of the spleen, in that arteries invade the lymphatic nodules and continue into the sinus areas. Large venous sinuses are developed in the sinus areas. These convene and transmit the blood away from the organ, principally at the hilus.

As mentioned by Trautmann and Fiebiger, red lymph nodes should not be confused with true nodes. The red nodes, such as the normal renal lymph nodes of the sheep or goat, are red in color because of the entrance of erythrocytes into the sinuses from the afferent lymphatics, and probably also by way of migration through the thin walls of veins in the lymphatic tissues. It is believed that this possible confusion can be ruled out in this case by the facts that the cortical substance was very typical to that of a true hemal node and that no lymphatic vessels, afferent or efferent, were found.

Summary

True hemal lymph nodes were found in a mature Greyhound during a routine dissection in a gross anatomy class at Auburn University. The identification of these hemal lymph nodes was confirmed by cytological examination. The literature is reviewed concerning the occurrence of true hemal nodes in the dog.

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Medical Interchange

Notes and abstracts screened from the medical literature for their special interest to veterinarians by Lynn Stratton Morris.

Histochemistry May Aid To Classify Animals

Histochemistry may become useful in the future classification of animals.

The distribution of alkaline phosphatase in the skin of 13 species of animals was studied by Drs. S. Randolph Scheen, Jr., and R. K. Winkelmann of the Mayo Foundation, Rochester, Minn. A striking variation was found.

Specimens of the skin were taken for biopsy from the dog, cat, lion, loris, monkey, chimpanzee, gorilla, rabbit, guinea pig, calf, hamster and rooster.

Monkeys and great apes were similar to human beings in distribution of the enzyme; other animals showed variation in localization. In the dog the sweat glands showed intense phosphatase activity, yet the capillaries, except for single vessels in large nerves, were negative. The cat and lion were again unusual in that there were no positive blood vessels, but the sweat glands, sebaceous glands and mammalian sensory end-organs were positive. In addition, a network of fine structures showing alkaline phosphatase activity was demonstrated about the sensory hairs of the lip. These may be sensory nerves associated with the sensory hairs.

In the rat and hamster positive superficial capillaries were noted; however, in the guinea pig and rabbit the vessels were negative.

The hoof of the calf was the only specimen showing both positive capillaries and positive end-organs of sensory nerves. The vascular pattern of the hoof is quite remarkable, with capillary trees extending high into the epidermis and scattered capillaries, positive for alkaline phosphatase, deep in the dermis.

In the rooster a specific difference in activity again was noted in that there were no positive structures in the skin from the footpad or from the body, but a large nerve trunk in the comb was positive.

Whether the positive reaction of the sensory end-organs of the cat, lion and calf indicates a higher degree of specialization and function of these organs is a matter for conjecture. Considering the species differences indicated by the animals studied, one might theorize that eventually it may be possible to classify animals on the basis of their specific histochemical reactions.

Arch. Dermatol., 83:439-446, March, 1961

Heat Increases Susceptibility To Lead Poisoning

A high environmental temperature affects susceptibility to lead poisoning, a series of experiments on laboratory animals idicates.

A. M. Baetjer, D.Sc.; S. N. D. Joardar, M.Sc., and W. A. McQuary, M.Sc., of the School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, found that dehydration produced by water restriction further increased mortality. They suggest that the findings may explain the marked increase in childhood lead poisoning in summer.

Mice and rats injected intraperitoneally or intravenously with lead had a significantly higher mortality and accelerated rate of dying when exposed to 95 F. than when exposed to a temperature of 70 F. Similar results were found in mice chronically poisoned with lead when subsequently exposed to heat. The effects of high temperature could not be attributed entirely to an increase in metabolism caused by the temperature, since thyroxine treatment did not produce as marked an effect.

Decreased food consumption, weight loss and reduced activity, characteristic of heat exposure, when produced at normal temperature were without effect on lead poisoning.

The effect of the high temperature was greater when the heat exposure began after the injection of lead than when the exposure also preceded the injection of lead. Also the effect of heat was neither augmented nor diminished by continuous preinjection exposures up to 30 days. Thus, the immediate physiological changes in response to heat, rather than prolonged heat stress, played the major role in increasing susceptibility to acute lead poisoning.

Experiments in nonsweating animals, such as rats and mice, cannot reproduce the exact conditions which exist in man upon exposure to heat. However, dehydration, produced by water restriction, is comparable to sweat loss in some respects. In these experiments severe dehydration increased the mortality of lead-poisoned mice at all temperatures.

Analysis of lead in feces and urine demonstrated a greater retention of lead by rats at the 95 F. temperature. The effects of humidity were not significant.

Arch. Environmental Hlth., 1:463-477, December, 1960

New Antibiotic Spray Beneficial for Wounds

A new tetracycline-neomycin spray combination for topical treatment of infected wounds has been found beneficial once the basic surgical treatment has been carried out.

Dr. Timothy A. Lamphier of Boston found the spray therapy particularly useful in sterilizing wounds and promoting rapid healing. Local antibiotic therapy, however, does not replace the basic treatment of infected wounds including débridement of necrotic tissue or the incision and drainage of abscesses.

The antibiotic combination is prepared in 2 forms, a spray powder and a spray ointment (petrolatum base). Both are supplied as sterile products. Selection depends on the degree of moisture in the wound being treated. The author limited the spray powder to "wet" wounds and used the spray ointment for dry wounds, especially in the treatment of burns.

In a total of 228 cases studied, the preparation gave excellent results. There were no untoward reactions on wound healing resulting from the freon contained in the spray. The combination effectively and quickly removed the odors connected with infected wounds.

According to *in vitro* studies, the spray powder demonstrated bactericidal activity

against *Pneumococcus, Streptococcus zymogenes* (enterococcus), *Staphylococcus aureus, Aerobacter aerogenes* and *Proteus mirabilis* organisms, and bacteriostasis against beta hemolytic *Streptococcus, Escherichia coli, Salmonella typhosa* and *Pseudomonas aeruginosa.*

The investigator concludes that the combination (available as Surgamycin) is effective in the topical treatment of infected wounds, especially those resistant to other forms of therapy. It also may be used in clean wounds to reduce the possibility of infection.

Jour. Internat. Col. Surgeons, 35:224-February, 1961

Child Infected With Capillaria Hepatica

A case of genuine infection with *Capillaria hepatica* (*Trichocephalus hepaticus* or *Hepaticola hepatica,* a nematode of the family *Trichocephalidae,* the same family as *Trichuris trichiura*) in a 20-month-old male infant has been reported by Dr. Simon Calle, Department of Pathology, Duke University School of Medicine.

After pathologic studies established a definitive diagnosis of granulomatous hepatitis due to *Capillaria hepatica,* the child was treated with dithiazanine iodide (Delvex). Initially, the patient seemed to improve, as indicated by the decrease in liver size, a decline in the leukocyte count and return of temperature to normal. At the end of 2 weeks of treatment (150 mg./day) the drug was discontinued.

The patient was discharged in good clinical condition 49 days after admission. Five months later and 10 months after his primary illness began, the child was found to be doing well.

Several factors were considered in determining the way in which the boy acquired the infection. There were many dogs, cats and rats in his environment and he was known to have eaten earth on several occasions. The fact that his father worked in a veterinary hospital could have had some bearing on the problem.

This is the eighth case in man to be reported, the fourth to be diagnosed by liver biopsy, and only the second case in which the patient is still living.

Genuine and spurious infection in man by *Capillaria hepatica* must be carefully distinguished. In genuine infection the parasites are present in the liver and there they deposit their ova. Clinical evidence of infection results, but the ova are not excreted in the feces. In spurious infection there is no definite clinical evidence of infection, even though ova are present in the feces of the patient. The ova are nonembryonated and are simply passing through the gastrointestinal tract following ingestion of infected material by the host.

The incidence of *Capillaria hepatica* in animals has been investigated by a number of workers. It has been found in the liver of rats, (in Baltimore, Luttermoser found the parasite in the liver of 85.6% of 2,500 adult rats and 21.5% of 136 juvenile rats), mice, dogs, muskrats, beavers, rabbits, peccaries, monkeys, squirrels, pigs, cats and other animals. In man it is a rarity.

Pediatrics, 17:648-655, (April) 1961

Inheritance Factor In Leukemia Possible

Possibility of an inheritance factor in leukemia is being given added weight by detailed studies of cows whose incidence of lymphosarcoma is a matter of concern to dairy operators.

According to a report from the American Cancer Society, which is sponsoring the investigation, certain cattle families have shown such a high rate of the disease that the researchers are beginning to believe that an inheritance of susceptibility may exist and that the causative agent itself may be transmitted from mother to daughter.

Med. Trib., 2:21 (March 27) 1961

Clinical Research

Serum Interference with Modified Live Hog Cholera Vaccines

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It is well known that passive antibody serum levels may prevent the development of active immunity against certain viral diseases. With canine distemper, for example, protective levels of passive antibody prevent an active immune response in dogs whether they are exposed to fully virulent virus or are vaccinated with a modified virus.

That there is interference with active immunity when serum is given simultaneously with killed hog cholera vaccines, notably crystal violet vaccine, has been previously established.[1] It has been generally believed however, that there is no serum interference associated with the use of modified live virus hog cholera vaccines. Nevertheless, failures in immunization following vaccination with modified live hog cholera viruses do occur and often are associated with the administration of anti-hog cholera serum given several days prior to vaccination. The experiments reported here were conducted to determine whether the passive antibody interference phenomenon may play a part in hog cholera immunization failures.

Originally 2 rabbit origin modified live virus vaccines were used, one of high rabbit passage (Swivax, Pitman-Moore) and one of lower rabbit passage (Swivine, Pitman-Moore). The virulent virus and serum used in these experiments were commercial virulent virus produced for use in the simultaneous method of vaccination and commercial anti-hog cholera serum.

Susceptible pigs weighing 50 lb. to 60 lb. were given various doses of serum and were vaccinated with rabbit origin modified live virus either simultaneously or at intervals ranging from 24 hours to 21 days later. Vaccinated pigs and controls that had received serum only, as well as controls that were untreated, were challenged with virulent hog cholera virus at intervals of 42 to 76 days after serum administration and were observed for 14 days. Necropsy examinations were made of all pigs that died. In 3 tests the modified virus vaccine was given subcutaneously; in 1 test some of the pigs were vaccinated subcutaneously and some intramuscularly. The pigs in these experiments were Hampshires, Poland China or Poland-Hampshire crossbreds. For each experiment the pigs were obtained from a single herd and were held together under farm lot conditions.

After the foregoing experiments had been completed, an additional experiment was conducted with modified live hog cholera virus vaccines of tissue culture origin and of porcine origin to determine whether

any differences existed in serum interference potential.

Experiment 1: Thirty-two pigs weighing approximately 50 lb. to 55 lb. were used in this experiment. Fourteen pigs were each given 40 cc. of anti-hog cholera serum, 14 were each given 80 cc. of serum, and 4 of the pigs received no serum to serve as untreated virus controls.

At intervals of 24, 72 and 120 hours after administration of serum, groups of 4 pigs that had received 40 cc. of serum and 4 pigs that had received 80 cc. of serum were given 2 cc. of high rabbit passage vaccine subcutaneously. Two pigs given 40 cc. of serum and 2 pigs given 80 cc. of serum were left untreated to serve as serum-treated virus controls. Forty-two days after the administration of serum, all pigs were challenged with 2 cc. of virulent virus subcutaneously.

Experiment 2: In this experiment 44 pigs weighing approximately 55 lb. to 60 lb. were used. Twenty were each given 40 cc. of serum, 20 were each given 80 cc. of serum, and 4 were left as untreated virus controls. At intervals of 24, 72 and 120 hours, a group of 3 pigs that had received 40 cc. of serum and a group of 3 pigs that had received 80 cc. of serum were vaccinated with 2 cc. of high rabbit passage vaccine intramuscularly, and similar groups at each interval were given 2 cc. of the same vaccine subcutaneously. Two of the pigs given 40 cc. of serum and 2 given 80 cc. of serum were left as unvaccinated serum-treated virus controls. All pigs were challenged with virulent virus on the 76th day after administration of anti-hog cholera serum.

Experiment 3: Forty-eight pigs weighing approximately 60 lb. were used in this experiment. Twenty-nine pigs were given 40 cc. of serum each, 8 pigs were given 10 cc. of serum each, and 11 pigs were left untreated. Of the 11 untreated pigs, 3 were given 2 cc. of high rabbit passage vaccine, 4 were given 2 cc. of lower rabbit passage vaccine, and 4 pigs were left as untreated virus controls. Of the 8 pigs given 10 cc. of serum, 4 were vaccinated simultaneously with high rabbit passage and 4 with lower rabbit passage vaccine. Separate groups of pigs that were given 40 cc. of serum were vaccinated with one or the other passage level simultaneously, or at intervals of 3 days and 7 days after the administration of serum. Four pigs that received 40 cc. of serum were left unvaccinated as serum-treated virus controls. All pigs were challenged on the 59th day after anti- hog cholera serum administration.

Experiment 4: In this experiment, 50 pigs weighing approximately 55 lb. were used. Forty-five of the pigs were given 40 cc. of serum each. The remaining 5 pigs were left as untreated virus controls. Five of the pigs receiving serum were left as unvaccinated serum-treated virus controls. At intervals of 7, 14 and 21 days after serum administration a group of 5 or 6 pigs was vaccinated with 2 cc. high rabbit passage (H.R.P.) and another group with lower rabbit passage (L.R.P.) vaccine. Five serum-treated pigs were vaccinated with 2 cc. virulent hog cholera virus (V.V.) 4 days after the administration of serum. All pigs were challenged with virulent virus 71 days after the administration of anti-hog cholera serum.

Experiment 5: Eighty-three pigs (Hampshire and Poland China) were used in this experiment. Ten pigs weighing about 40 lb. were used as vaccine controls and were vaccinated simultaneously with the administration of 15 cc. of serum; 5 with tissue culture origin vaccine and 5 with porcine origin vaccine. The other 73 pigs in this experiment weighed 50 lb. to 55 lb., and 66 of them were given 40 cc. of serum. Three, 5 and 7 days later, 10 pigs were vaccinated with tissue culture origin vaccine and 10 with porcine origin vaccine; in each case, 5 of the pigs received no additional serum, and 5 were given 15 cc. of additional serum at the time of vaccination. The remaining pigs were kept as contact and noncontact virus controls. All pigs were challenged with virulent virus 76 days after the administration of anti-hog cholera serum.

Results

In all experiments, the pigs were held and observed for 14 days after challenge with virulent hog cholera virus. Postmortem decomposition prevented an adequate histologic study of some of the pigs that died. In all other cases, however, complete necropsy examinations, including bacteriologic and histologic studies, were made and yielded findings consistent with hog cholera virus infection. All pigs that survived challenge remained well throughout the period of observation.

Experiment 1: As shown in the table, there was evidence of some serum interference with the development of active immunity when the high rabbit passage vaccine was given 24 to 120 hours after the administration of serum. The fact that some pigs treated with serum alone survived challenge, whereas all of the untreated virus controls died, indicates that passive antibody protection had not entirely disappeared at 42 days.

Experiment 2: The results of this experiment give further evidence of some serum interference when the high rabbit passage vaccine is given 24 to 120 hours after serum administration. However, the serum interference shows no correlation either with the amount of serum given or the route (subcutaneous or intramuscular) of vaccine administration. Failure of the serum-treated virus controls to resist challenge indicates that protective levels of passive antibody had disappeared by the 76th day.

Challenge Results after Vaccination of Pigs in Experiment 1

cc. of Serum (4-23-58)	Vaccination (Hours after Serum) 24	72	120	No. Died/ No. Tested
40	+			0/4
80	+			1/4
40		+		2/4
80		+		2/4
40			+	2/4
80			+	1/4
40	Serum-treated virus controls			1/2
80				0/2
....	Untreated virus controls			4/4

Challenged 6-4-58

Challenge Results after Vaccination of Pigs in Experiment 2

cc. of Serum (7-30-58)	Vaccination (Hours after Serum) 24	72	120	No. Died/ No. Tested
40	I.M.			0/3
40	S.C.			0/3
80	I.M.			1/3
80	S.C.			1/3
40		I.M.		1/3
40		S.C.		0/3
80		I.M.		0/3
80		S.C.		0/3
40			I.M.	0/3
40			S.C.	1/3
80			I.M.	0/3
80			S.C.	1/3
40	Serum-treated virus controls			2/2
80				2/2
....	Untreated virus controls			4/4

Challenged 10-14-58

Experiment 3: All pigs vaccinated with either the high or the lower rabbit passage vaccine simultaneously with the administration of 10 cc. or 40 cc. of serum survived

Challenge Results after Vaccination of Pigs in Experiment 3

cc. of Serum (1-13-59)	Vaccination (Time after Serum) High Rabbit Passage: No Serum	Simult.	3 Days	7 Days	Lower Rabbit Passage: No Serum	Simult.	3 Days	7 Days	No. Died/ No. Tested
40		+							0/4
40						+			0/4
10		+							0/4
10						+			0/4
40			+						0/4
40							+		1/4
40				+					1/4
40								+	1/5
....	+								0/3
....					+				0/4
40	Serum-treated virus controls								3/4
....	Untreated virus controls								2/4

Challenged 3-23-59

Challenge Results after Vaccination of Pigs in Experiment 4

cc. of Anti-Hog Cholera Serum (7-28-59)	Vaccination (Days after Serum) H.R.P. 7	H.R.P. 14	H.R.P. 21	L.R.P. 7	L.R.P. 14	L.R.P. 21	V.V. 4	No. Died/ No. Tested
40	+							0/6
40		+						1/6
40			+					0/6
40				+				0/6
40					+			0/6
40						+		0/5
40							+	0/5
40	Serum-treated virus controls							5/5
....	Untreated virus controls							5/5

Challenged 10-7-59

challenge, as did all pigs vaccinated without serum. The results in those vaccinated at 3 or 7 days after the administration of 40 cc. of serum again indicated some serum interference. One of the 4 serum-treated virus controls in this experiment survived, and only 2 of the untreated virus controls died after challenge. Necropsy examination of one of the vaccinates that died revealed tuberculous lesions in the lymph glands in addition to lesions associated with hog cholera.

Experiment 4: Only 1 pig, vaccinated with the high rabbit passage vaccine on the 14th day after the administration of serum, died after challenge in this experiment. Histopathologic studies of this pig and the control pigs, all 10 of which died, revealed an aseptic viral type of encephalitis that is considered one of the most reliable diagnostic criteria in hog cholera studies. No passive antibody interference occurred in the 5 pigs vaccinated with virulent hog cholera virus 4 days after the administration of serum.

Experiment 5: All pigs that were vaccinated with either tissue culture or porcine origin modified live virus vaccine, with simultaneous administration of 15 cc. of anti-hog cholera serum, remained well after challenge. Some of the pigs vaccinated with either product at intervals of 3, 5 and 7 days after the administration of 40 cc. of serum died of hog cholera after challenge with virulent virus 76 days after the serum was given. Lack of any consistent pattern in deaths among pigs that received additional serum at the time of vaccination and those that did not, suggests that the additional serum did not influence the results under the conditions of this test. All noncontact virus controls died after challenge. Some contact virus controls died after challenge, both among pigs that received serum

Challenge Results After Vaccination of Pigs in Experiment 5

Vaccine	cc. of Anti-Hog Cholera Serum (8-12-60)	Vaccination (Days After Initial Serum) Simultaneous	3 Days No Serum	3 Days 15 cc. Serum	5 Days No Serum	5 Days 15 cc. Serum	7 Days No Serum	7 Days 15 cc. Serum	No. Died/ No. Tested
	15 cc.	+							0/5
Tissue	40 cc.		+						2/5
	40 cc.			+					0/5
Culture	40 cc.				+				1/5
	40 cc.					+			2/5
Origin	40 cc.						+		1/5
	40 cc.							+	0/5
	15 cc.	+							0/5
	40 cc.		+						0/5
Porcine	40 cc.			+					3/5
	40 cc.				+				2/5
Origin	40 cc.					+			2/5
	40 cc.						+		1/5
	40 cc.							+	0/5
Contact Virus Controls	40 cc.								1/3
	None								3/4
Noncontact Virus Controls	40 cc.								3/3
	None								3/3

Challenged 10-27-60

at the beginning of the test and those that did not. As with the rabbit origin modified live virus vaccines, these results indicate some passive antibody interference with both of the products tested when vaccination is done between 3 and 7 days after the administration of 40 cc. of serum.

Discussion

The results obtained in these experiments indicate that there is no serum interference with the various types of live hog cholera vaccine tested when serum is given simultaneously. When vaccine was administered from 24 hours to 14 days after serum, however, there was evidence that passive antibody interfered with the establishment of solid immunity in some pigs. Evidence of passive antibody interference was found with all types of vaccine used in these experiments. While no evidence of passive antibody interference with virulent virus was obtained in the limited number of pigs tested in experiment 4, excessive serum has been reported to interfere with virulent virus in the development of active immunity.[3]

The peak of serum interference would appear to occur at some time after the 1st day and before the 7th day after serum administration. The passive antibody level of interference becomes less significant between 7 and 14 days after the administration of serum. The one pig that failed to resist challenge following vaccination 14 days after serum (experiment 4) may have been an exceptional case, since previous work showed no serum interference when rabbit origin modified live virus was given at intervals of 1 to 4 weeks after the administration of serum.[2] Table 6 summarizes the losses observed in pigs vaccinated in these 5 experiments.

These data have considerable significance with respect to the interstate movement of swine. At present it is required that all swine shipped interstate be given serum before they cross the state line. Vaccination of such pigs is done subsequent to their entry into the state. Thus, many pigs undoubtedly are vaccinated at a time when they have interfering levels of passive antibody. This could serve to explain many of the vaccination breaks encountered in such pigs. The same situation undoubtedly applies to pigs moved intrastate through sales barns.

Consideration should be given to the problem of serum interference in the vaccination of swine leaving sales barns or shipped interstate. On the basis of these data, vaccination of all pigs with modified live virus and simultaneous serum prior to leaving a sales barn or before being shipped interstate could result in the reduction of vaccination breaks. Veterinarians, of course, should continue to be alert to the possibility that under present conditions of traffic in pigs, the histories of some shipments are vague or questionable. In some such cases the possibility exists that the imported pigs

TABLE 6

Summary of Results in Pigs Challenged with Virulent Hog Cholera Virus after Vaccinated With Various Types of Modified Live Hog Cholera Vaccines

Vaccination (Days After Serum)	No. Died/No. Challenged				Total Tested	Total Died
	Rabbit Origin		Tissue Culture Origin	Porcine Origin		
	High Passage	Lower Passage				
Simultaneous	0/8*	0/8	0/5	0/5	26	0
1	3/20				20	3 (15%)
3	5/24	1/4	2/10	3/10	48	11 (23%)
5	5/20		3/10	4/10	40	12 (30%)
7	1/10	1/11	1/10	1/10	41	4 (10%)
14	1/6	0/6			12	1 (8%)
21	0/6	0/5			11	0

Pigs challenged with virulent hog cholera virus from 42 to 76 days after initial serum.

may recently have received serum without vaccine and therefore might not all respond to immediate vaccination, or that they may have received no prophylaxis. Practitioners, therefore, would be well advised to take these factors into consideration when called to vaccinate such a group of pigs. Pretreatment exposure to virulent virus is another possibility that obviously should not be overlooked.

Summary

Some degree of serum interference with an active immune response to four types of modified live virus hog cholera vaccine has been demonstrated. No interference occurred when vaccine and serum were administered simultaneously, but some interference occurred when vaccine was given 24 hours or more after serum. The peak of interference appears to occur after 1 day and before 7 days following serum and seems to be of little significance after 7 days. These results suggest that simultaneous vaccination of pigs with modified live virus and serum would be preferable to the practice of giving serum only and should result in a reduction in vaccination breaks in pigs leaving sales barns or shipped interstate.

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Western Equine Virus Winters in Snakes

The western equine encephalitis virus hibernates in winter in snakes, according to Drs. Leo A. Thomas and Carl M. Eklund of the National Institute of Allergy and Infectious Diseases' Rocky Mountain Laboratory.

In the summer, birds infected by the *Culex tarsalis* mosquito (primary vector of WEE virus) serve as a reservoir of infection. But until now no one had discovered how the virus maintains itself in winter.

The Rocky Mountain investigators got their clue when they spotted the *C. tarsalis* mosquito swarming over a colony of hibernating garter snakes. Tests later proved that the reptile not only is susceptible to infection, but that the resulting viremia is of high titer and long duration. Wild snakes inoculated with the virus in the fall, then allowed to hibernate, reappeared in the spring still carrying the virus in high titers.

Moreover, uninfected *C. tarsalis* mosquitoes allowed to feed on the inoculated snakes could infect one-day-old chicks after 9 to 23 days. And the virus could be recovered from both insect and chick.

The investigators expect to complete their case by examining the remaining question: Will wild garter snakes collected in fields also carry the virus?

The report appeared in *Proceedings of the Society for Experimental Biology and Medicine.*

Med. World News, 2:5 (March 17) 1961

Sheep Walkie-Beep

Since sheep always follow their leader, Australian farmers no longer have to worry where their flocks have strayed. The sheep tell the farmer exactly where they have gone.

A tiny radio transmitting set, developed by the Commonwealth Scientific and Industrial Research Organization, is strapped to the back of the sturdiest sheep in a flock and sends out a periodic "beep" to be picked up by the farmer on his direction-finder set.

Knowledge of the whereabouts of the flocks is of particular economic importance during lambing season and shearing time.

Sci. News Letter, 78:327 (Nov. 19) 1960

Cattle Practice

Observations on Bovine Milk Fever

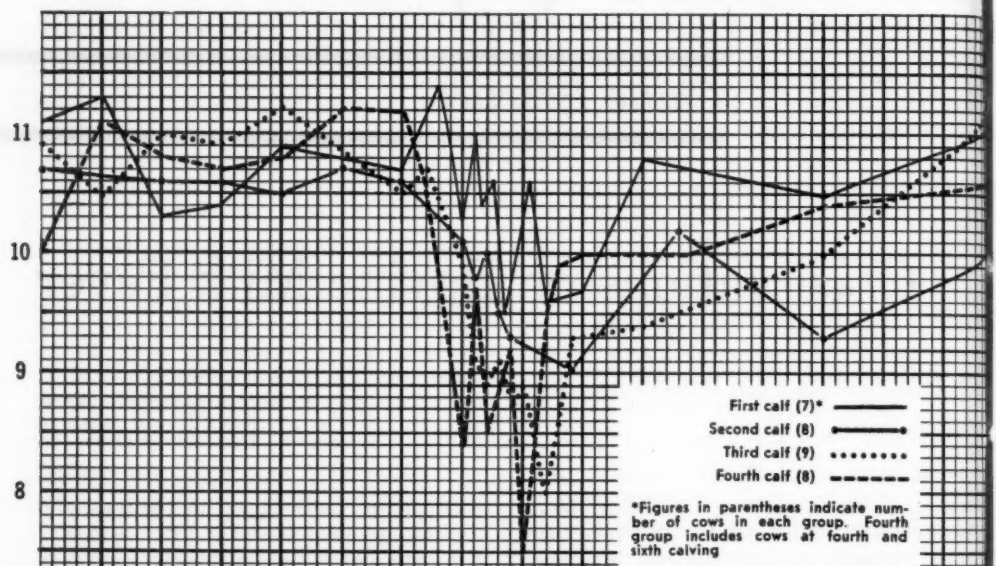
Rudolph Seiden, D. Sc. Tech.
Vice President, Pharm. Research
Haver-Lockhart Laboratories, Inc.

The term "milk fever" is a misnomer. Very rarely does fever accompany this very common, widespread and serious affliction, which is primarily a metabolic disorder occurring in dairy cows and occasionally in ewes. It is known by various names; *e.g.*, parturient paralysis, parturient paresis or parturient hypocalcemia. Milk fever is often observed a few hours after calving but may be delayed for a few days or even weeks. It is characterized by depression, collapse, spasms of the neck muscles, inability of the downer cow to get up, lowering of all body functions and often also of the body temperature. The calcium level of the blood is usually much lower than the normal 10 mg. % to 11 mg. %. A Russian investigator recently stated that the following changes can be observed 12 hr. to 48 hr. before the cow goes down with milk fever: slower rumen movements, faster breathing, lower skin temperature and higher blood pressure.[1]

In the more complicated cases of the milk-fever syndrome, the condition is more complex than the mentioned symptoms indicate. Often the calcium deficiency is accompanied by phosphorus and magnesium deficiencies, particularly if pastures and feed rations are deficient in these elements.[2] For instance, in the northwestern parts of the United States the soil and, therefore, the plants grown on it are often low in magnesium and phosphorus. This close relationship between soil-plant-animal deficiencies was long overlooked. Long known, however, is the fact that high-producing and well-nourished animals are more susceptible to this acute condition than poorly fed cows. Another interesting observation is that the disease very rarely occurs at the first calving, but is most frequent after the birth of the 3rd to 7th calf. The condition is likely to recur at subsequent calvings in a cow which once had an attack.

The situation can become very complicated, since the milk-fever syndrome may consist of any or all of the following conditions: hypocalcemia, hypophosphatemia, hypomagnesemia, and/or hypoglycemia. Hypomagnesemia, also called grass tetany, is often fatal. It may develop soon after recently freshened cows are turned out on a lush pasture.[3] On the other hand, in some rare cases of this syndrome, hypermagnesemia may be observed.

COMPARISON OF CHANGES IN SERUM CALCIUM IN NORMAL PARTURIENT COWS OF DIFFERENT CALVING GROUPS


11
10
9
8
7
7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8
First calf (7)*
Second calf (8)
Third calf (9)
Fourth calf (8)
*Figures in parentheses indicate number of cows in each group. Fourth group includes cows at fourth and sixth calving

It should be emphasized that a fall in the blood calcium level occurs even in the normal cow at parturition time (see graph). It is also a well-known fact that the parathyroid mechanism plays an important role before and during parturition. Insufficiency of the hormone may be the basic cause of the secondary hypocalcemia. Not all the biochemical and physiological problems involved in the development of the milk-fever syndrome are fully understood at present. It is probable that an increase in the nutritional levels of available mineral elements, and particularly of calcium and phosphorus (and vitamin D) during the last 2 or 3 months of pregnancy is beneficial. Calcium is better utilized when there is a proper proportion of phosphorus available in the feed.

Before World War I the most common milk fever treatment was inflation of the udder with oxygen or air. This mechanical mammary distention prevented further interchange of calcium and other elements from the blood to the mammary gland. The distention may even reverse the interchange, forcing the calcium back into the blood.

For a few years, infusion of potassium iodide solution into the udder was widely recommended, but a more satisfactory treatment became available with the injection of calcium salts, first calcium chloride, then calcium gluconate and other calcium compounds. More recently, large doses of vitamin D_2 or D_3 or dihydrotachysterol have been given orally or parenterally for the prevention of milk fever. But the results from these preventative measures have not been entirely satisfactory. Thus, the parenteral administration of calcium-containing preparations remains the standard treatment of the milk fever complex.

Because calcium gluconate is only about 3.3% soluble in cold water and solutions up to 30% calcium are required by some veterinarians, the use of stabilizers or crystallization inhibitors, such as boric acid, aluminum chloride and calcium hypophosphite, have been added to the solution. Many of these solutions also contain, if compatible with the stabilizer, therapeutic amounts of magnesium and/or phosphorus salts. Dextrose is often added to them. A high-producing cow has greatest need of these elements and dextrose, as there is an excessive loss of them in the milk.[3]

According to analytical findings,[4] healthy cows show the following average composition of milk and blood (expressed in percent by weight, Table 1). In analyzing these figures, we note that the first 4 ingredients are always present in higher concentration in milk than in blood, which explains why certain deficiencies are manifested almost exclusively in the producing female. The daily output of 12.5 liters of milk from a cow weighing 900 lb. (and having 68 lb. of blood) greatly depletes her system of dextrose, calcium, phosphorus and magnesium (Table 2). We can understand that even liberal feeding will not arrest the total loss.

The milk : whole blood ratios in both tables show very clearly that lactating animals require calcium, phosphorus and magnesium in addition to sugar. If any one is missing or deficient, a surplus of the other elements will be of no value. The cow will not recover or will suffer recurrence of symptoms.

In parturient paresis the calcium and inorganic phosphorus content may drop 50%, according to J. W. Hibbs.[5] In grass tetany, calcium may drop as much as 30%, inorganic phosphorus, 5% and magnesium more than 70%.

TABLE 1
Average Composition of Bovine Blood and Milk

	Percent Milk	Percent Whole blood	Ratio Milk:Blood
Sugar	4.800	0.070	68.6:1
Ca	0.144	0.005	28.8:1
Mg	0.012	0.002	6.0:1
P (total)	0.079	0.018	4.4:1
K (potassium)	0.155	0.338	1 :2.2
Cl (chlorine)	0.103	0.308	1 :3
Na (sodium)	0.038	0.270	1 :7.1
Fe (iron)	0.00027	0.038	1 144.4

TABLE 2
Total Mineral Content of Milk and Blood in a 900 lb. Cow Producing 3½ Gallons of Milk per Day

	Daily Depletion by Output of 3¼ Gal. Milk, in Grams	Total Content in the 68 lb. of Blood of 900 lb. Cow, in Grams	Ratio Milk:Blood
Sugar	600.00	21.70	27.7: 1
Ca	18.00	1.55	11.6: 1
Mg	1.50	0.62	2.4: 1
P (total)	9.88	5.58 (2.36 inorganic P)	1.8: 1
K	19.38	104.79	1 : 5.4
Cl	12.88	95.48	1 : 7.4
Na	4.75	83.70	1 : 17.6
Fe	0.034	11.78	1 :346.5

Very rarely, if ever, has a practicing veterinarian occasion to undertake a complete blood analysis before treating the downer cow. Such a blood analysis would be done by physicians treating human beings suspected of an obscure mineral-deficiency disease. Therefore, the simultaneous administration of one or all of the 3 minerals which may be deficient is, so to say, an "insurance policy." It assures the success of the deficiency tratment, provided there are no other complicating factors involved in the case. Even if the condition is simple hypocalcemia, the other minerals will not cause harm because the unused portion of the injected mixture of mineral salts soon will be eliminated in the urine.

But the theory that if a little is good, more should be better, just does not work. In fact, an overload of calcium may damage the weakened heart of the downer cow. Basing his calculations on the findings of such authorities as H. H. Dukes and D. L. Coffin, W. E. LaGrange[6] declared at a recent conference that there is much misuse of calcium therapy and that the rational dose for the treatment of parturient paresis of a large dairy cow is 5 gm. to 6 gm. of elemental calcium.

Many milk-fever remedies used today contain much more calcium, magnesium and/or phosphorus than a cow would need if she had lost the total blood content of elements.

Most of the stabilized calcium gluconate preparations now on the market are too acid and too concentrated to be used by other than the intravenous or intraperitoneal route. For this reason, calcium levulinate (calcium content 13.1% against 8.9% of calcium gluconate U.S.P.) and some other more water-soluble calcium salts are now frequently used. Their aqueous solutions are nearly neutral and often more diluted than the old, established calcium gluconate preparations, yet they contain as much calcium. Thus, they lend themselves well to longer-lasting subcutaneous and intramuscular administrations which are often preferred, particularly when a cow which is known to have relapses is being treated.

Among other compounds now available on the American or European market and employed in parenteral calcium preparations for veterinary use are calcium glucoheptonate, calcium glutamate, calcium glycerophosphate, calcium lactobionate and calcium d-saccharate.[7] There are in addition others still in the experimental stage. Many of these salts act as solubilizers for calcium gluconate and are therefore sometimes used together with it. However, exposure to freezing and shaking may cause formation of "seedlings" of these solutions and precipitation of calcium gluconate.

While calcium therapy for the milk fever complex is well established, the importance of phosphorus for the treatment of this condition is only slowly being recognized. Calcium hypophosphite was first used as a stabilizer for calcium gluconate in the United States.[8] It was soon afterwards employed in parturient paresis by W. Hallgren[9,10] in Sweden. He found that in a group of 881 affected cows, 85% responded favorably to intravenous calcium therapy, but 77 cases which did not respond even to repeated treatment were further examined. Twelve of these could be attributed to normal relapses, but the remaining 65 with the normal milk fever symptoms had low serum phosphorus instead of low serum calcium. They responded favorably to calcium hypophosphite injections.

A Dutch researcher, A. Osinga,[11] observed that the stress of parturition not only decreased the blood serum calcium, phosphorus and Ca:Mg ratio, but the cholesterol content as well.

Discussions with experts in the United States and in Europe have supported the theory that there is no advantage in treating the milk fever complex with highly concentrated solutions. Even the most concentrated borogluconate solutions cannot prevent relapses,[12] and properly balanced, diluted calcium-phosphorus-magnesium solutions are preferable and safer.

Present-day milk fever therapy consists of parenteral injection of concentrated calcium salts that are stabilized with such preparations such as boric acid or calcium hypophosphite and some with therapeutic amounts of magnesium and/or phosphorus. Large quantities of these solutions should not be used because an overload of calcium may damage a weakened heart.

Observations by workers studying the milk fever syndrome indicate that properly balanced, diluted calcium-phosphorus-magnesium solutions are safer, just as effective and preferable to concentrated solutions.

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Management of the High Potential Cow

Dairy feeding programs have not generally kept pace with breeding of the inherent ability to produce milk. As a consequence, many high-producing cows are not returning as much over feed cost as they have the capacity to do so.

A 1,200 lb. to 1,400 lb. cow producing 12,000 lb. to 15,000 lb. of milk a year will use only 50% of her total nutrient intake for body maintenance while a 1,000 lb. to 1,100 lb. cow, producing only 5,000 lb. to 7,000 lb. of milk per year, will use 2/3 of the total nutrients for maintenance.

Research evidence has shown that it pays to feed the cows that will produce and to feed them according to the amount of milk production. High levels of milk production are the most profitable as shown by the following recent summary of New York State DHIA data.

Pounds of Butterfat per Year	Returns over Feed Cost
351	$218.00
455	304.00
541	355.00

If the feed cost is held down, there will be a low net return from the cow. There is no limit to the amount of grain fed that can be returned over cost. This is demonstrated by the famous "85" cow in the Michigan experimental herd. The following table demonstrates the influence of amount of grain fed this high-potential cow.

Lactation	Pounds of Grain	Pounds of Milk	Returns over Feed Cost
3	4,626	14,100	$352.00
4	1,815	11,461	298.00
5	6,058	18,997	517.00
6	50	8,904	231.00

The following management practices are recommended to aid in getting maximum production from high-potential cows.

1. Know what each individual cow can do and feed accordingly. Appetite is the only limiting factor in determining the amount of grain a cow will consume.

2. Evaluate the roughage to find the probable proportion of nutrients it is providing. Some feed companies are now providing such a service.

3. Feed grain in proportion to milk production.

4. Lead cows with grain intake during the early lactation period to find upper limits. Increase grain intake gradually. When a cow does not consume all the grain at 1 or 2 feedings, cut back the amount.

5. Adjust grain intake to milk production and body condition once a month.

6. The feeder assumes greater importance as grain intake increases over 20 lb. of grain per day.

7. For cows producing between 40 lb. to 60 lb. of milk per day increase grain intake up to 28 lb. in 30 days following parturition.

8. Provide plenty of fresh water at all times.

9. Feed the best cows the earliest cut hay.

10. Not more than 50% of roughage nutrients should be provided by silage or body weight and milk production will go down.

11. Feed the cows adequately while on pasture.

Gilbert H. Porter
Illinois State Meeting, 1961.

Breed Incidence Of Tumors

Clinical experience points to the greater prevalence of certain tumors in specific breeds of cattle. These observations by clinicians are in a measure supported statistically. There is greater frequency of so-called "eye cancer" (squamous cell carcinoma) in those Herefords having a low degree of pigmentation in the lids. Approximately 60% of malignancy of the vulva occurs in Ayrshires or classes of this breed and 40% in other dairy breeds. On the basis of the foregoing observations, attempts are being made to prevent the tumorous conditions genetically. This would appear to be a logical approach to the problem rather than to confine efforts solely to surgical extirpation.

Bovine Tail Bleeding Procedure

Blood can be obtained from the coccygeal vein in the bovine. The only equipment needed is a 10 cc. (preferably Luer-lok center tip) nylon syringe and a 16 gauge needle.

Procedure: Using moderate pressure, the tail is held straight over the cow's back. The ventral midline groove of the vertebrae is located between the 2nd and 4th coccygeal vertebrae and the needle is inserted about ½ inch distal to a joint. It is advanced into the groove at a 45 degree angle until the bone is touched. As the needle and syringe are eased back, the operator slowly aspirates until the required amount of blood is obtained.

Precautions: Any kink in the tail will distort the relationship of the blood vessels and make it more difficult to enter the vessel. It is more difficult to enter the vessel in heifers because they are smaller and there is less flesh. For the same reason it is difficult in thin animals. To help overcome this, move proximally where the tail is fleshier. It is also more difficult to bleed from fractured tails.

Iowa State Univ. Vet., 23:25, 1960

Eye Speculum

An eye speculum for animal surgery has been devised by Dr. R. P. Thomas and Walter Terry of the Department of Ophthalmology, Bowman Gray School of Medicine, Winston-Salem, N. C, The speculum affords excellent exposure, eliminates lid pressure and gives an uncluttered field.

Animal eye surgery is sometimes difficult because of trouble handling the lids and nictitating membrane. Human speculums generally are unsatisfactory because they are difficult to maintain in position and usually result in poor exposure. Although lid sutures may be used, they are inconvenient and often give inadequate exposure.

The new speculum, which may be obtained from the authors, is simple, sturdy and self-retaining. It consists of a length of spring steel wire, fashioned with several small hooks to retract the lids, and is gently curved to conform to the palpebral fissure. It will stay in place by its own tension or may be locked in place. The nictitating membrane may be pulled aside with the hook on the speculum.

Am. Jour. Ophth. 50:660, (October), 1960.

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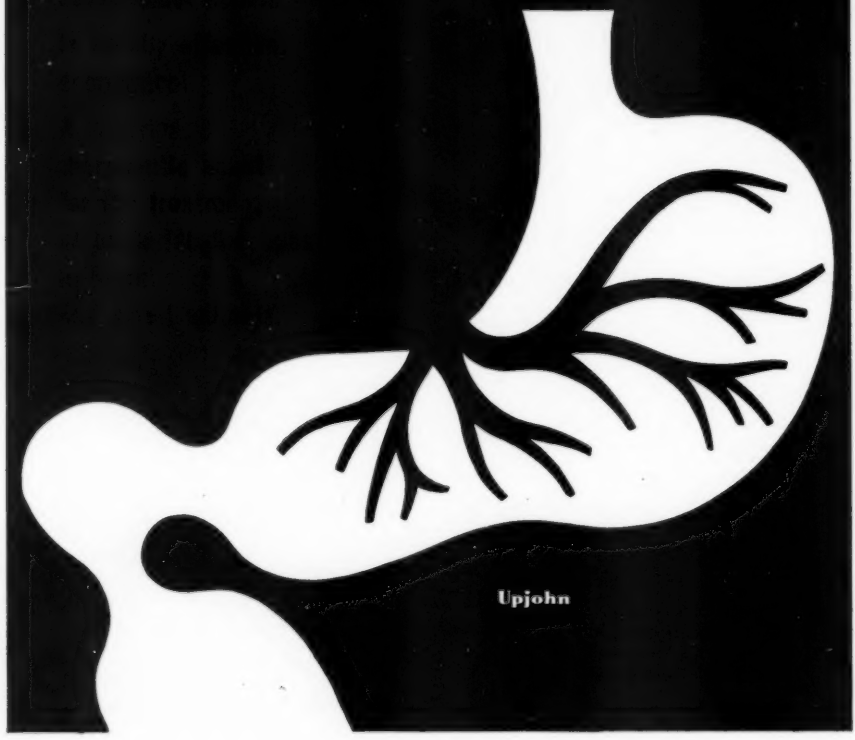
New York 18, N. Y.
Veterinary Department

Biosol-M*

blocks



Upjohn